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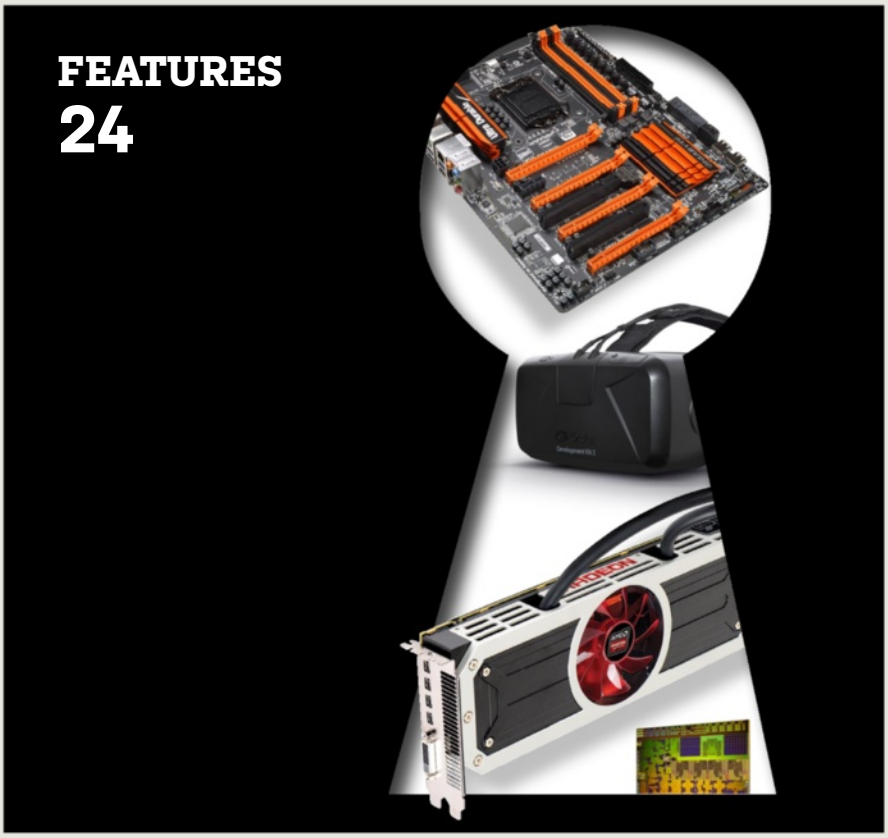

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EDITORIAL
Editor-in-Chief: Gordon Mah Ung
Managing Editor: Alaina Yee
Online Managing Editor: Jimmy Thang
Senior Editor: Tom McNamara
Contributing Editors: Alex Castle, Josh Norem
Contributing Writers: Pulkit Chanda, Tom Halfhill, Sean D. Knight, Paul Lilly, Thomas McDonald, David Murphy, Quinn Norton, Mark Wilson, Henry Winchester, Chris Zele
Copy Editor: Mary Ricci
Intern: Clark Crisp
Editor Emeritus: Andrew Sanchez

ART
Art Director: Richard Koscher
Photographer: Mark Madeo

BUSINESS
Vice President, Content and Product: Kelley Corten, kcorten@futureus.com
Vice President, Sales & Business Development: Nate Hunt, nhunt@futureus.com
Associate Sales Director: Stacy Gaines, sgaines@futureus.com
Regional Sales Manager: Michael Plump, mplump@futureus.com
Regional Sales Manager: Tad Perez, tperez@futureus.com
Regional Sales Manager: Austin Park, apark@futureus.com
Regional Sales Manager: Jessica Reinert, jreinert@futureus.com
Senior Manager Sales Ops & Monetization: Michael Grinde, mgrinde@futureus.com

Vice President, Marketing & Sales Development: Rhoda Bueno
Director of Consumer Marketing: Lisa Radler
Newsstand Director: Bill Shewey

PRODUCTION
Production Manager: Mark Constance
Production Controller: Ian Wardle
Project Manager: Clare Scott,
Production Assistant: Emily Wood

FUTURE US, INC.
4000 Shoreline Court, Suite 400, South San Francisco, CA 94080
Tel: 650-872-1642, www.futureus.com

Senior Vice President / General Manager, Digital: Charlie Speight
Vice President, Finance & Business Management: Lulu Kong
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REPRINTS
Future US, Inc., 4000 Shoreline Court, Suite 400,
South San Francisco, CA 94080
Website: www.futureus.com
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Non-executive Chairman: Peter Allen
Chief Executive: Zillah Byng-Maddick
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Gordon Mah Ung

PURE PC POWER

I HAVE SPENT the last 15 years of my life at *Maximum PC*. First, as online editor for *boot* magazine, back when AGP cards were new and overclocking was practically illegal. Along the way, there have been many changes—expansion, "shrinkage," more change, and even more change after that.

This month, we say good-bye to our award-winning art director, Richard Koscher. We wish him well in his endeavors. Just so you know, Rich engineered the art and concept behind the yellow Dream Machine of 2011. How good was the cover Rich crafted that year? A committee of civilians—and likely Mac users—chose an enthusiast PC magazine that casually uses terms like PCIe 3.0, MLC nand, and bclock for its coveted award. We beat out some of the biggest-name magazines in the United States for that prize, and we owed it all to Rich.

Rich isn't the only change though. Last month we said good-bye to habitual staffer Josh Norem, who has worn the *Maximum PC* editor hat no fewer than three times. Luckily, Josh continues to write for us, as we all know being a PC enthusiast is a lifelong passion (and I'm hoping he'll come back for run four in the future). A new face is our Managing Editor Alaina Yee, who has a thing for mini-ITX and micro ATX builds. And since this is an Academy Award moment, let me also thank Copy Editor Mary Ricci, who amazingly strains out so many errors every month.

It's a lot of change, but as we know, life is all about change and new beginnings. For me, too. As I said, I started as *boot*'s online editor and was welcomed aboard by none other than legendary figure Brad "Big Daddy" Dosland. Others who have come before me include Jon "Philly" Phillips, Michael "Brownie" Brown, and of course, the unforgettable Will Smith, who I think still owes me lunch money from April 12, 2007.

Of course, earlier this year, we said good-bye to Editor-in-Chief Katherine Stevenson, whom I worked alongside for more than a decade, and was our steward through some tough times.

I'm going through this long list of predecessors because this month I am officially taking the helm of *Maximum PC* as Editor-in-Chief and can only rely on what I've learned from those who have gone before me.

As I'm the place the blue screen stops, I think it's a good moment to restate our mission parameters. It's simple and goes back to *boot* issue No. 1: Pure PC Power, baby. Nothing else needs to be explained. If we veer away from that message, you know who to yell at.

Gordon Mah Ung is Maximum PC's Editor-in-Chief, senior hardware expert, and all-around muckraker.

↘ submit your questions to: comments@maximumpc.com

THE NEWS

Seeing Red

A flaw in Internet encryption called "Heartbleed" exposes a long-standing "emperor's clothing" situation

WHEN YOU access your bank account on the Internet or when you use your credit card at an online store, you've been told that you have a reasonable degree of security and privacy because of SSL encryption. Secure Sockets Layer scrambles your personal information so that only the intended receiver can see it. There are several versions of this, with OpenSSL being one of the most popular. As its name implies, OpenSSL is open-source, so anyone can inspect the programming code and use it in their own security systems without paying a licensing fee. Unfortunately, we've learned that even source code that's exposed to countless trained eyes can still have some serious weaknesses.

Turns out that OpenSSL has had a fairly exploitable bug in it for a couple years now (discovered only recently by security testing firm Codenomicon) that allows sufficiently motivated middle-men to intercept everything sent over that protocol. Here's how it works: A computer sends a test packet of data over the network to an OpenSSL server, checking for its heartbeat. The size of the returned packet must be identical. When the computer sends this packet to the server, it has one instruction for the information that it wants back, and another instruction for the amount of data required to return that information.

In the affected version of OpenSSL, the server basically gets confused when a malicious sender gives it a packet with a large mismatch. The sender asks for the word "computer" but wants that response in, say, 500 characters instead of eight. The bugged server makes up for the shortfall by collecting random data from a memory buffer—basically the computer equivalent of our short-term memory. The problem is that this buffer can contain sensitive, confidential information, from passwords to actual encryption keys, depending on what kind of traffic the server usually handles. So, if the malicious user just keeps sending these malformed packets, they could eventually suck up a lot of private data, to either use for their own purposes or to sell on the black market. Making matters worse, servers can be set up to work this exploit on individual computers that use the bugged version of OpenSSL.

What does this mean for regular home desktop users? Well, due to the amount of time that the bug went undiscovered, and how uncomplicated it is to exploit, its effects range far and wide. Any password you used to log into a system that used OpenSSL can be considered compromised and must be changed. If you used that password anywhere else, those accounts must have their passwords changed, too. Generally, you want to have separate passwords for anything containing information that you don't want to broadcast, like your stock portfolio or credit card statements. Password managers like KeePass and LastPass help immensely here. They can create long, hack-resistant passwords, and you only need to remember one master password to access them all.

Things will be more difficult for the companies that relied on OpenSSL to protect their users. Rob Enderle, principal analyst of Enderle Group, tell us, "Companies that make the extra effort should have fewer problems like this, and enjoy higher customer loyalty. They may even be able to sustain higher prices for the perceived quality that results. Just remember with 'free' or 'cheap' comes a cost, and we just saw that cost demonstrated with Heartbleed. You own the quality of your products. If you don't make the effort to assure it, whatever happens to your brand and reputation is your fault." **–Tom McNamara**

The security firm that discovered Heartbleed created this logo to raise awareness.

Seagate Ships 6TB HDD

So much for SSDs killing hard drives anytime soon. Seagate says it's now shipping a whopping 6TB hard drive aimed at cloud-based data centers. The new 3.5-inch drive spins at 7,200rpm, comes with a 5-year warranty, and ships in either SAS or SATA configurations. Seagate's 6TB baby follows on last year's Hitachi/Western Digital's 6TB drive, which resorted to filling the drives with helium. Helium is thinner than oxygen and lets Hitachi cram an unheard-of seven platters in its drive. The Seagate drive has a 128MB cache and is spec'ed to hit sequential transfers of 200MB/s. The drive is priced competitively with Hitachi's drive, at about $500 to $600 on the street. **–PL**

Start Menu Return in August?

First, the Start *button* came back in Windows 8.1, and now it looks like Microsoft may fold and bring back the actual Start Menu in a new version of 8.1 arriving by the end of this summer. Stories from veteran Microsoft reporter Mary Joe Foley indicate Microsoft is prepping Update 2, which will introduce the long-missed Start Menu to the OS. The removal of the button and menu in Windows 8 has long been a point of contention and anger for Windows users who have rejected using the Modern touch interface for desktop computing. Perhaps even more embarrassing than its attempt to push Modern as its preferred interface is the possibility that Modern apps may be allowed to run in a window in desktop mode. **–PC**

Wi-Fi Gets an Upgrade

Can't move that video file across your wireless fast enough? That should change in the coming year with new chipsets that promise to push data rates that will easily exceed your hard drive's transfer speeds. Broadcom says it will hit 3.2Gb/s (nearly 400MB/s) with its new 802.11ac Multi User MIMO chips, which can use six streams simultaneously—about a 50 percent improvement over current MIMO routers. Broadcom's new chip can push six 802.11ac streams and three 802.11n streams simultaneously. Not to be left behind, competitor Quantenna says it is prepping a 10Gb/s, or nearly 1,200MB/s, chipset. The chipset will use an 8x8 configuration to achieve the throughput that's aimed mostly at the high end. Quantenna's 1.7Gb/s chipset, touted as the fastest around, is currently inside Asus' 4x4 MIMO router. **–PL**

Tom Halfhill Fast Forward

RADIO BEAMFORMING COMES OF AGE

I'VE BEEN jaded by years of technology demos. Recently, however, I was blown away when an engineering team developing a new type of microwave oven baked a whole fish that was frozen in a large block of ice—without melting the ice! To prove the fish was fully cooked, they chopped a hole through the still-frozen block and inserted a meat thermometer. The fish was cooked, all right. Steaming and ready to eat!

It wasn't a practical demo. The point was to show that this prototype oven is much more efficient than a conventional microwave oven. Instead of flooding the chamber with microwave energy and heating everything, it directs the energy straight into the food. In fact, the fish baked so quickly that its radiant heat had no time to melt the ice.

The underlying technology is radio beamforming—shaping a radio signal for maximum efficiency. And the next wave of 802.11ac Wi-Fi routers will use the same technology to share radio frequencies among multiple users without interference. In Wi-Fi, it's called MU-MIMO (multiuser multiple input/multiple output).

When two or more nearby users are vying for the same frequencies, the router communicates with their client devices (computers, tablets, smartphones, whatever) and tunes the signal for each one. This technique requires multiple antennas at each end and some intelligent software that can strengthen or weaken the gain on each antenna to shape the signal—hence the term "beamforming."

In the olden days, we practiced a crude form of this technology by fiddling with a TV's rabbit ears to pull in a distant station. Even today, you've probably repositioned your cell phone to improve reception in a fringe area. Beamforming takes the next step by adaptively reconfiguring the transmission, too. But don't worry—the focused signal is still too weak to cook your head.

Tom Halfhill was formerly a senior editor for *Byte* magazine and is now an analyst for *Microprocessor Report*.

Thomas McDonald Game Theory

BREAKING FREE OF THE PACK

SOMETIMES I LOSE patience with the dull monotony of the products being pumped out by the major game publishers. Just to pick one example, I'd be fine never seeing another military shooter. Call of Duty beat that genre senseless, took it out back and capped it in the head, buried it, dug it up, re-animated its rotting corpse, turned it into a zombie game, and then killed it again.

In this wide ol' world of ours, there are so many subjects, and so many stories to tell, that I have no idea why we keep returning to the same fountains. Haven't we drained most of the potable water from the Tolkien, guns, and/or zombie wells? I'll grab at anything that's a little bit different, which is why Steam Greenlight and other indie forums are so vital for PC gaming. The style, form, subject matter, and gameplay of the indie just tends to be more interesting.

For example, strategy games in general, and turn-based games in particular, never go out of fashion, yet when pressed to make a new one, most designers fall back to the sci-fi, fantasy, or military tropes we've already seen a thousand times.

That's why Turnopia's Qvadriga is such a find. There hasn't been a strategy game about ancient Roman chariot racing on the PC since Avalon Hill released an adaptation of their classic board game, Circus Maximus. That was in 1984: *30 years ago.*

It may sound like a niche inside a niche, but racing board games in general, and chariot games in particular, have a long history filled with many venerable titles. The genre scratches an itch for a unique set of tactics, as you choose just the right moment to accelerate, slow down, maneuver, and even attack other racers. Qvadriga captures all of this in a remarkably well-designed and appealing package.

I doubt most gamers have ever played anything like it, and that's exactly why they should give it and other oddball titles a spin. You never know what you may find.

Thomas L. McDonald is Editor-at-Large of *Games Magazine*.

Tablet PCs May Stunt Child Development

Maybe parents should rethink giving their children a tablet next holiday shopping season, especially if their lifestyle makes it difficult to limit the use to such devices. Members of the Association of Teachers and Lecturers are speaking out against overexposure to tablets, warning that a growing number of infants aren't developing the proper motor skills to play with building blocks due to their "addiction" to tablet PCs and smartphones.

According to a report in U.K. newspaper the *Telegraph*, teachers claim that three- and four-year-old children know how to swipe a screen just fine—but beyond tablet controls, they lack dexterity in their fingers after spending hours a day playing on an iPad.

"I have spoken to a number of nursery teachers who have concerns over the increasing numbers of young pupils who can swipe a screen but have little or no manipulative skills to play with building blocks or the like, or the pupils who cannot socialize with other pupils but whose parents talk proudly of their ability to use a tablet or smartphone," Colin Kinney, a teacher from Northern Ireland, told the *Telegraph*.

Teachers have also noted a decline in pen-and-paper exams, saying that kids who spend a lot of time using mobile gadgets rely on the instant support of their electronic device. The obvious way to combat against all this is for parents to do a better job monitoring and limiting the amount of time their children are allowed to use tablets and smartphones. In addition, teachers recommend turning off Wi-Fi access at night. **–PL**

AMD Refreshes Game Bundle

Hardware maker AMD has refreshed its Never Settle Forever free game bundle with new games and new tiers, including one that was not yet available as this issue went to press. Murdered: Soul Suspect, an action-adventure game about a ghost trying to find his killer, was slated to be published by Square Enix on June 3rd in North America. You can also select a two-game indie bundle including Banner Saga and Guacamelee. Each indie bundle counts as one choice. AMD also has a "Ruby" tier, giving you four bundle choices, available when you buy a pre-built system with certain AMD cards inside. **–PL**

Sony Laptop Recall

If there's anything we've learned about laptop batteries over the years, it's that they occasionally catch on fire. Sony announced that it had received several reports of the Vaio Fit 11A's battery overheating and causing partial burns to the laptop. The company has asked owners of the laptop to refrain from using it until a recall program had been fully implemented. The Fit 11A's battery is not removable, so it can't be replaced by the user with a correctly functioning unit. Fit 11A owners will need to send them to Sony for repair or replacement. Sony recently agreed to sell its Vaio division so that it could focus on mobile devices. **–PL**

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Quinn Norton
Byte Rights

AN INFINITY OF A GOOD THING

ONE DAY, AS I was hunting around for amateur and fan-created music on the net, I realized something. I could listen to free original music, not pirated, every day until I died, and never repeat a tune. Maybe not all of it is the best music, but certainly some of history's most enthusiastic efforts.

Music used to require an object, equipment, a distribution chain. Now, all those things are harder to find than the music, of which there is far too much. Music used to be scarce, and now it is abundant. This is why there is so much confusion and rhetoric around online music: It changed, but we didn't update our legal and economic systems.

The world is a mix of things scarce and post-scarce. There's never enough time or BMW i8s for everyone, but we have more funny cat pictures and bad T-shirts than anyone could possibly want. A look at your garage may confirm that you live in a post-scarce abundance, in terms of crap.

When it comes to information, we have traded scarcity for the big-data problem—far too much of a good thing!

But our economic and legal systems treat everything as measurably small and intrinsically difficult to share. We have industries based on trying to take abundant things away from people, which have to be backed up by the force of law, because that's so hard now. Our whole system is set up to treat anything desired by someone as rare. No one teaches us to distinguish actually scarcity, like the time of an artist who needs the support of his or her fans. We need to fix our thinking, and realize much of what we want these days are things that everyone can have too much of, like instant ramen noodles.

Until we start thinking about how abundant many things really are, our society will make terrible legal and economic choices.

Quinn Norton writes about copyright for Wired News and other publications.

PC Game Revenue Explodes

If having superior graphics, processing, and electronic delivery of games isn't enough to make you feel smug, PC gaming may have just surpassed the global annual revenue of console gaming, according to a new report from DFC Intelligence. Company owner David Cole told PCR-online.biz that PC gaming should break $25 billion this year. The growth area, he says, has been "multiplayer online battle arenas" such as DOTA 2, with MMOs, strategy, and first-person shooters also representing nicely. Breaking it down by region, DFC said Europeans have been rolling in free-to-play, while the United States is still the land of the AAA title. **–SK**

AT&T to Get More Fiber

In the wake of Google Fiber announcing potential expansion into dozens of regions around the country, telecom colossus AT&T is weighing in with its own program that encompasses up to 100 candidate cities. Possible winners include San Francisco, Los Angeles, Houston, Chicago, Atlanta, and other large metropolitan areas where pilot high-speed broadband programs rarely venture. The physical network would use the company's "U-verse with GigaPower" service. The vanilla U-verse already delivers TV, telephone, and high-speed Internet over a combination of fiber-optic cable and conventional copper wire, but GigaPower is an all-fiber deal. It's too soon to know when this will happen or what they'll charge, but we'll keep you posted. **–PL**

Tech Tragedies and Triumphs

A monthly snapshot of what's up and down in tech

TRIUMPHS

4-TERABYTE SSDS
Sandisk announces a whopping 4TB enterprise solid-state drive, designed for enterprise customers and envious onlookers.

DUAL-GPU RADEON
AMD delivers the R9 295X2. Its specs include integrated liquid cooling and a second mortgage.

FREE MOBILE HULU
The company announces that some shows will be available for free on mobile devices, thanks to commercials.

TRAGEDIES

ATARI'S SECRET LANDFILL
Documentary film crew unearths hundreds of unsold game cartridges, turning an embarrassment into riches.

VERIZON INTERNET
The telecom giant lines up behind Comcast, charging Netflix for the privilege of providing content to its customers.

AOL BREACH
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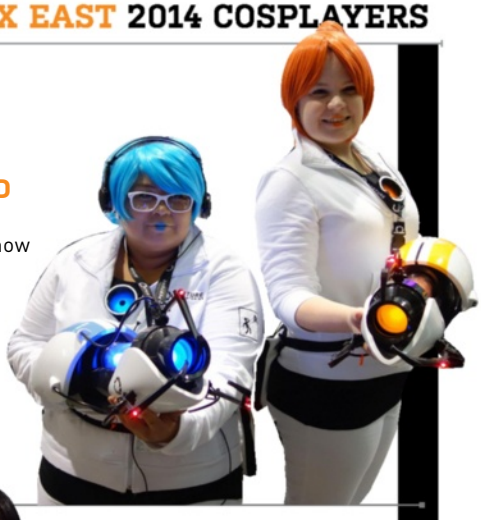
THE LIST

8 BEST PAX EAST 2014 COSPLAYERS

8 GORDON FREEMAN

We asked him if he grew out his goatee for the outfit, but like Gordon Freeman, he didn't talk.



4 ATLAS AND P-BODY

Portal robots, now in human form!

7 AMUMU

The Nurse Akali outfit is good, but the Amumu cosplay steals the show.

3 MEDIC

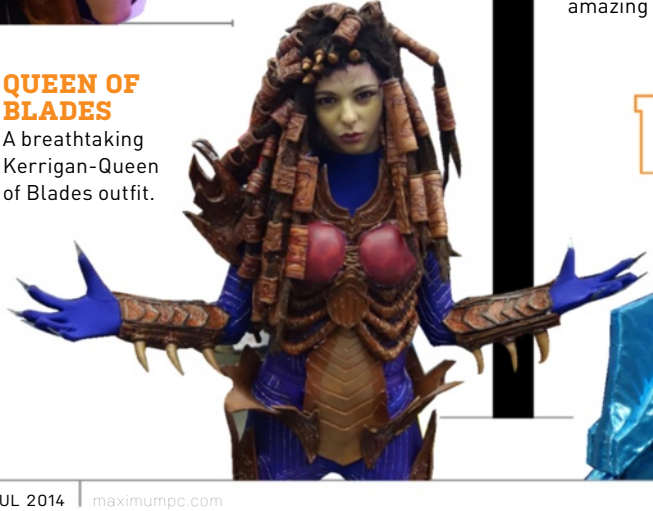
The medic, always happy to heal.

6 BOOKER DEWITT

This is what we call a very accurate Booker DeWitt costume.

2 JAYCE

His axe transforms and changes colors. It looks even more amazing in person.



5 QUEEN OF BLADES

A breathtaking Kerrigan-Queen of Blades outfit.

1 ANIVIA

That can't be easy to walk around in, but he perfectly captured Anivia's look.

CyberPower recommends Windows

CYBERPOWERPC

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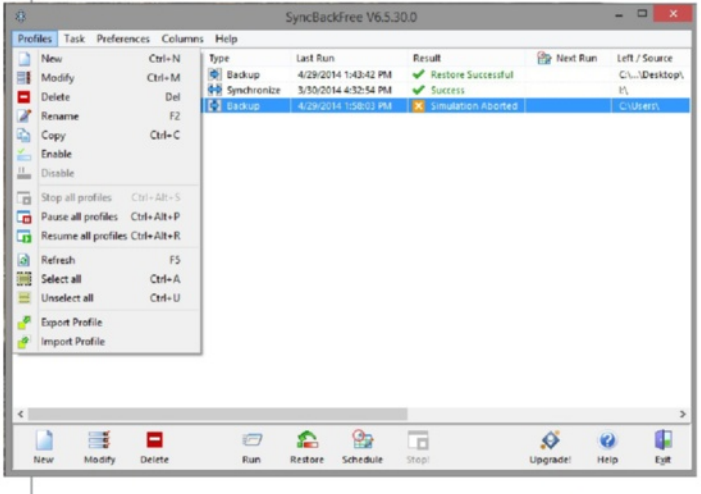
Work easy, play hard Windows 8

HEAD TO

BY **JOSH NOREM**

SyncBackFree Vs. EaseUS Todo Backup Free

All data-storage devices fail, given enough time, so you need a backup plan in place for when it happens. You're also, er, frugal and don't want to pay for it, so this month we're pitting two free file backup utilities against one another to find out which deserves your hard-earned download. Both utilities offer more advanced features in their paid version, but we are focusing solely on their free versions here. Let's get it on!



SyncBackFree's spartan interface is all business but is simple and easy to understand.

ROUND 1

Basic Features

SyncBackFree lets you set up three types of backup scenarios: backup for individual files from one internal drive to another; synchronize for two directories or volumes that need to remain the same; and "mirror" for two drives or directories when changes only happen in one direction. Todo Backup is an entirely different animal in that it lets you backup disks, partitions, and your entire system in addition to performing rudimentary file backup. It also lets you clone disks and partitions, which SyncBackFree does not offer. You can also set up a WinPE pre-boot disk, or a Linux rescue disk, in addition to being able to back up an Android device (but not an iOS device). Suffice to say, this category is an easy win for Todo Backup, which has a crazy amount of features and options right out of the box, no upgrade required.

Winner: Todo Backup

ROUND 2

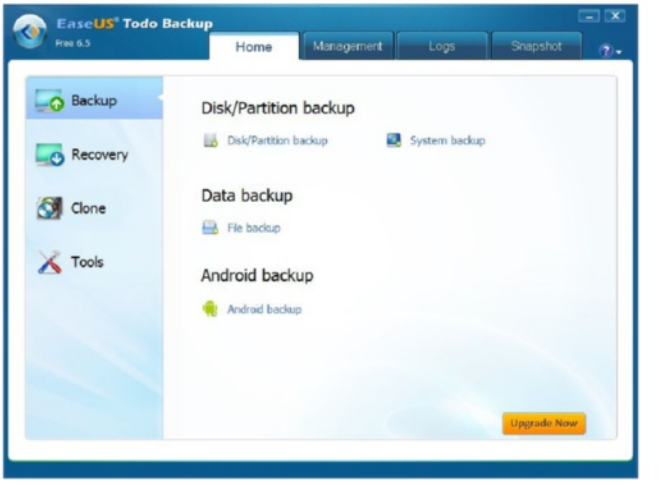
Performance

Though most backups take place while we are in dreamland, you still want a program that runs quickly, simply because operations that take forever to complete hog system resources and seem wasteful. It's also a problem if you're trying to restore files and can't wait forever to get them back. To see which program is faster in backing up and restoring files, we created a 35GB test folder filled with a range of different files, from documents to photos and PDFs, and tested each software package. SyncBackFree was the clear winner, as it performed at more than twice the speed of Todo Backup, taking just 2 minutes and 25 seconds to perform a backup, compared to Todo Backup's six minutes. Restoring with SyncBackFree was also much faster, requiring only 3:24 to Todo Backup's 6:26 for the same operation. We're not sure why Todo Backup is so slow, but it stood in stark contrast to SyncBackFree's zippy operation in our testing.

Winner: SyncBackFree

HEAD

It's crazy how many features are available in Todo Backup's free version—crazy!



ROUND 3

Advanced Options

Having the ability to fine-tune a backup program is important to us, and we like to configure backup rules to our liking. Since both of these apps are free, the ability to tweak them is somewhat limited (the paid versions offer a ton more options), and it's clear that SyncBackFree offers a crapload more options for file backup, whereas Todo Backup offers more advanced options, but severely restricts your options inside those routines. Both utilities give you the ability to drill down into folders to select specific files to back up, and both also let you schedule backups, though the free version of Todo only a weekly backup, whereas SyncBackFree lets you schedule any interval. SyncBackFree also lets you fine-tune incremental backups, a feature not offered by Todo Backup. Though Todo Backup has more features, SyncBackFree has many more advanced options, despite its narrower backup focus.

Winner: SyncBackFree

ROUND 4

Ease of Use

Both of these programs are quite simple to use, and even a PC newb should be able to use them. Both basically let you choose a source and a destination for file or disk backup, then take it from there. That said, given the sensitive nature of file management and the concern we all have about inadvertently deleting files or wiping out entire volumes, it's critical that each app shows you exactly what it's doing at all times. In this regard, SyncBackFree is easy to use but is tailored to advanced users, whereas Todo Backup is so easy to use we are pretty sure even the newest newb could use it, thanks to its large icons and intuitive "wizard-style" interface. SyncBackFree uses a "wizard," too, but it's mostly text-based, and not exactly user-friendly. Both programs send you a log file when there's an error, however, which is appreciated.

Winner: Todo Backup

ROUND 5

File Recovery

Both utilities approach file recovery in a straightforward manner, but we like Todo Backup's method a little bit more due to the extra options it offers. SyncBackFree lets you run a profile you've set up (a backup routine) in either backup or restore mode, and lets you choose to restore it to its original location or choose a new location. Once it's complete, the files are there in their original form, so there's very little drama, but also very few options. Todo Backup, however, lets you recover specific files from within a backup set, or recover specific types of files, and you can even search for a file by name. From there, you can recover it to its original location, specify a new location, and choose whether or not to overwrite any existing files. It's not a huge difference, but it's enough to give Todo Backup the nod in this category.

Winner: Todo Backup

And the Winner Is...

This was a close match, and both are superb backup utilities, but despite our long-term love affair with SyncBackFree, we must declare **Todo Backup** the winner. With its abundant features and slick interface, it now occupies our free-backup place of honor. We like how it's much more than just a file-backup utility, and that it includes advanced features even in the free version. It's definitely much slower than SyncBackFree, but that's a small price to pay for an excellent backup utility.

DOCTOR

THIS MONTH THE DOCTOR TACKLES...

> Power Supplies
> SSDs
> Boot Issues

We Need More Power, Captain!

I'm looking to upgrade my PSU and I can't decide between a 750W, 850W, and 1,000W. I currently have a GTX 780 GPU and an Intel Core i7-2600K CPU, and know that a 750W would be quite enough. I had dual video cards in the past, so getting another GTX 780 could be a possibility in the near future. Is it better to have a 1,000W PSU and only use about 400W all the time, or could the PSU become somewhat lazy? I like my PC to be as quiet as possible, so PSU sound to a minimal is a must. What do you recommend? My budget is around $200.

—Martine

THE DOCTOR RESPONDS: This is a great question Martine, and it's one we get quite often because there's a lot of disinformation out there about how many watts a rig needs in order to keep everything running smoothly. First of all, most people wildly exaggerate how many watts they need for two reasons. First, they figure more watts can never hurt, and we don't necessarily disagree with that, if money isn't a factor. Second, people just like the sound of a high-watt PSU, because let's face it—it sounds badass to say you have a 1,000W PSU compared to a 650W unit. But the reality is you do not need more than 750W for two GTX 780 cards. The GPUs alone will take 500W right off the top, then add another 95W for the CPU, which leaves another 150W for your SSDs, hard drives, optical, add-in cards, and case fans, all of which might consume 5W each. So, even if you have a slew of drives, you probably still have 100W left on the table, which is more than enough as a buffer. You could theoretically take all 750W and the PSU should be just fine, but we do like to leave a little bit of breathing room to make sure the PSU isn't running at full capacity for extended periods. If you want to go with the 850W unit, we won't stop you, but you don't need the extra watts. You can also Google "PSU Calculator"—using the one named eXtreme Power Calculator Lite, we found that your system needs 562W. Just go for a name-brand unit and you'll be good to go. There are excellent PSUs to be found at http://www.jonnyguru.com.

A 750W PSU can handle any dual-card, high-end gaming PC. Anything more is just for show (usually).

SSD Reset

I am running Windows 7 64-bit and have replaced a 250GB Samsung 840 SSD with a 750GB Samsung 840 EVO. I wanted to reset the old SSD to factory default, but when I connect the old SSD, Samsung Magician doesn't recognize it even though Windows does. My only option was to clone the new drive over the old one. My question is: How do you exercise the reset option when you have two SSDs, one of which is the new system drive and the other is the old system drive? Also, cloning the new drive over the old one seems to be a better and faster way to do a complete system backup. What are your thoughts?

—Lee Reichel

THE DOCTOR RESPONDS: We're not sure why the Samsung Magician software for SSDs isn't recognizing your old drive Lee, but if you just want to use it for data storage, our recommendation is to simply format it like you would with any drive in Windows. Our assumption is that when you wrote, "reset to factory default" you meant secure erase, which drains all the charge from every cell on the drive and then sends a 100 percent Trim command to the drive to effectively delete everything. This is a "secure" way to delete all the data on the drive; but for your purposes, since you plan on writing over whatever is on there now, we'd just go with a format. You'll be fine since they accomplish the same

↘ submit your questions to: doctor@maximumpc.com

objective, though theoretically, data can still be recovered from a formatted drive. However, since you're not giving the drive away, there's no reason to make sure your old data is not accessible. As far as why the software doesn't see it, try connecting it to a different SATA port and see if that helps. The software should detect each drive and let you change settings and tweak them individually, and we've had zero issues with it in The Lab. For backing up your OS drive, you're not going to be able to maintain it on the smaller SSD over time due to the capacity difference, so we'd recommend just backing it up to an external drive.

SSDs and Battery Life

I travel a lot, so I am more interested in my Laptop's battery life than by how much data it can hold. My only speed interest is in the use of an SSD for my drive. When I have a unit built for me, a single 256GB SSD is sufficient. I read *Maximum PC* every month but do not remember ever seeing any SSD reviews that identified their power draw. Is this because an SSD power draw is too insignificant to matter, or that the power draw of a 256GB SSD would be the same as that of a 500GB SSD? I notice that this power draw statistic is not included in online retailer SSD information, either.

—Dennis Quicker

THE DOCTOR RESPONDS: You are correct in that we don't include power draw in SSD reviews; we do it for two reasons. First, we're primarily writing for an audience of desktop users, where power draw is simply too low for any type of drive to really be a factor in our verdict. Second, in general, we consider SSD power draw to be so low as to not make a huge difference in battery life between SSD models. Yes, it can make a difference when compared to a rotating platter drive, but the delta between two SSDs in terms of battery life would be so small that we don't think it signifies. SSDs draw about a third of the power of an HDD because they have no moving parts, and also run much cooler, thereby decreasing the overall temperature of the system, which results in less energy spent making cooling fans spin. That said, based on what we've seen tested, the best-case scenario for battery life improvement when moving from an HDD to an SSD is around 30 minutes total. You will not get much more than that, and it's possible you'll only see an improvement of 15 minutes or so, depending on how you use the drive. Still, the time-saving benefits of using an SSD over an HDD are more than ample reason for praise (and hardware dollars).

PC Shutdown

A few weeks ago, I started having HDD failure problems. At about the same time, I started having startup problems, so I thought they were related. I've fixed the HDD problems but the startup problems remain. If I just hit the power button on my tower or on my keyboard, the power will come on and immediately go off. The same thing happens if I go into the BIOS and use F10 to save and exit. I then have to unplug the cord or, better yet, turn off the switch on the PSU for about 10 seconds and try again, this time holding in the power button for a few seconds. This is my own build with a Gigabyte GA-880GM-D2H mobo, AMD Athlon II X2 270 CPU, EVGA GeForce GT 520 graphics card, SIIG sound card, ZuPower 400-watt PSU, 8GB SDRAM, and an Iomega keyboard.

—Michael Kidd

THE DOCTOR RESPONDS: It's always frustrating when multiple problems occur simultaneously, as it complicates troubleshooting. However, a PC shutting off a few seconds after boot can be caused by several factors. The first is a faulty power supply, which could be possible based on what you wrote, as that looks like a low-end model, and those are typically not the most reliable. Second, if the PC detects the CPU is overheating, it will shut itself off immediately, so it's possible that while you were fixing the hard-drive issues, you knocked something loose or mistakenly unplugged the CPU cooling fan (we're spit-balling here). It's also possible that whatever new component you added to the PC is causing the problem, so let's follow Rule #1 when it comes to PC hardware troubleshooting, which states that if you add or change anything in your computer and then experience a problem, remove whatever it was you just added and see if it goes back to normal. If it does, you've isolated your problem. If the issue persists, we'd swap out the PSU for a name-brand unit first, then look at possibly the motherboard as the culprit.

XP Standby

About one in every seven standby (S3) requests my PC makes will result in a computer freeze-up, requiring shutdown with the power switch or reset. The screen will show: "Preparing for Standby..." then the cursor and screen will freeze with the computer fans, the fan LEDs, and power LED on steadily. (The power LED flashes when it goes to standby correctly.) I'm using Windows XP Pro x64, and have been invoking Standby from Process Explorer v11.33. Invoking Standby from Start (Alt-F4) or the keyboard Sleep key results in the same intermittent freeze-up situation, but upon waking up MS Word does not work correctly and I have to restart it in Process Explorer to get it functioning correctly again. MS Word does work correctly after waking up from Standby request from Process Explorer—go figure. This is very frustrating. What can be going on here to cause these freeze-ups?

—Phil Saunders

THE DOCTOR RESPONDS: PCs refusing to "wake up" can indeed be frustrating, Phil, and we've been there before, too. The first thing we'd do as a test would be to close all open programs and put your PC to sleep manually. You can do this by changing the power settings in the Control Panel. Under the Advanced tab you can adjust how the PC enters standby. It could be an open program is causing a memory leak, so we'd close all of them, let it go into standby, and see if it can come back to life. Then, try leaving one program open at a time while going into standby to see if you can narrow it down to a specific program. You should also be sure to update your graphics drivers, as we've seen them cause problems like this before. We also looked on Microsoft's site for a discussion of this problem and found it in an article labeled #907477. It lists the following possible causes: outdated or incompatible device drivers, incompatible third-party software, and outdated BIOS or outdated hardware. It also recommends removing any USB devices before trying to wake the PC.

[SECOND OPINION]

KNOW THY DISTROS

Your response to dual booting Win 7 & Linux can be confusing. You mentioned using Ubuntu. The person that wrote the question may believe that Ubuntu is Linux. We know that the kernel is Linux, but if you go to Ubuntu's web site, you will not see the word Linux anywhere; just my observation.

— Bob

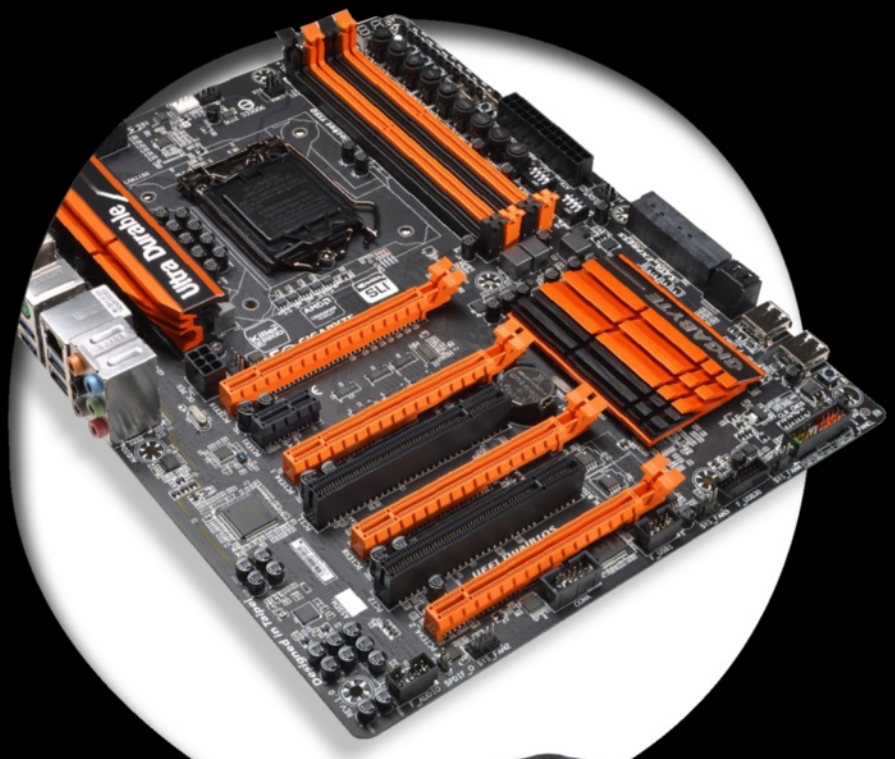
tech sneak peek

PC ENTHUSIASTS: BRACE YOURSELVES FOR SOME HOT HARDWARE

If you're looking for proof that the PC world is alive and kicking, look no further than the next few pages. We're giving you a summer sneak peek into a wave of PC hardware that's sure to get your blood flowing.

From new CPUs to socketed SoCs, dual dual-GPU video cards, and the arrival of SATA Express, there's never been a better time to be a fan of the desktop PC. Our sneak peek won't stop with this summer's hot hardware, though—we also give you all the info we can about the new PC hardware that's coming out through next year, too. So socket in, boot up, and get ready for a long, hot summer of hardware.

BY THE MAXIMUM PC STAFF AND JOSH NOREM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Z97 REVEALED

INTEL'S NEW CHIPSET IS A SMALL STEP FORWARD

We'll be frank: Intel's brand-new 9-series chipset is more evolutionary than revolutionary. That in itself is not really a bad thing in our book, as revolutionary things tend to be largely overrated. You'll really appreciate, for example, that the 9-series still uses the same LGA1150 socket as the 8-series. Those with longer memories will remember Intel kicking out slightly incompatible sockets when the temperature changed. So let's all at least give Intel credit for not making the 9-series on, say LGA1145, just to royally piss off those people who hoped to drop their existing Haswell CPUs into a new motherboard.

As cantankerous PC enthusiasts, we'll always find a way to gripe, though, and it doesn't take much more than looking at the feature set of the 9-series chipset, which could be just a Xerox copy from the 8-series. No surprise, it's a DDR3 "chipset," since the RAM controller is embedded into the CPU. It's also still "just" USB 3.0. Anyone who hoped USB 3.1 would make it into this chipset probably had unrealistic expectations anyway, as the spec was finalized too late to make the cut. We don't expect native USB 3.1 until at least 2015 at this point. PCIe lanes out of the chipset itself (not counting the PCIe 3.0 controller embedded in Haswell CPUs) are also still "just" PCIe Gen 2 spec.

If your eyes are already glazed over and you're considering bicycling down to Uncle Jim's CompuMart to hunt for bargains on a Z87 board for that new PC build, you should consider that in our book, you should skip Z87 for Z97.

THREE REASONS YOU SHOULD BUY Z97

The foremost reason is processor support. While both 8-series and 9-series support current and future Haswell processors, only 9-series boards will work with the upcoming 14nm Broadwell-based CPU. Yes, despite Broadwell being LGA1150, power requirements for the new CPU necessitated hardware changes, so most 8-series will be stranded. We say "most" because there is a chance that some 8-series boards will work with the upcoming Broadwell chip, but it's not guaranteed. Board makers would likely have to go back and validate their boards and UEFIs for Broadwell. With 9-series boards to hawk, you can bet making the old boards work isn't going to be a priority.

Now for the good stuff: Performance storage junkies get the bulk of the love with the 9-series chipset, which brings native support for both M.2 and SATA Express. M.2 is the mobile-oriented interface that promises 1,000MB/s transfer speeds—the same as SATA Express, and a healthy bump up from SATA 6Gb/s' roughly 550MB/s. M.2 and SATA Express won't give you all of the promised speed, though. Once you account for protocol overhead, both new interfaces will settle down around 800MB/s.

Z97 finally brings SATA Express to the table.

Z97 is the only chipset that will work with Intel's next-generation processors.

MEH?

We know, that's a little ho-hum, as it's "only" about 67 percent faster than plain SATA. It's even more meh when you consider that a pair of conventional SATA SSDs in RAID 0 will push 1,000MB/s. Too little too late, then? Like you, we initially wondered what the point was, but the move to M.2 and SATA Express is a great first step. Bandwidth could easily be doubled on both interfaces by moving from PCIe Gen 2.0 to PCIe Gen 3.0. Unfortunately, that can't be done on the 9-series chipset. It'll take a new chipset (perhaps the 10-series) before that can happen.

Still, we can't really be too ungrateful. We've been bitching for a year about SATA 6Gb/s bottle-necking SSDs, so to get a 67 percent increase is better than a kick in the shin. More importantly, the move to M.2 and SATA Express will finally decouple slower bulk-magnetic drives from faster non-volatile memory.

Many of the other tweaks to the 9-series chipset are also storage-related. There's officially support for bootable PCIe storage, an updated caching technology that supports PCIe devices for cache, and even chipset support for hard drives with internal SSDs.

Intel also adds a number of security-related features that will protect the PC's boot block against malware attacks. Overall, the 9-series chipsets—Z97 and H97—aren't revolutionary, but we'd definitely bypass a new Z87 board or system for one with Z97 at this point.

CyberPower recommends Windows

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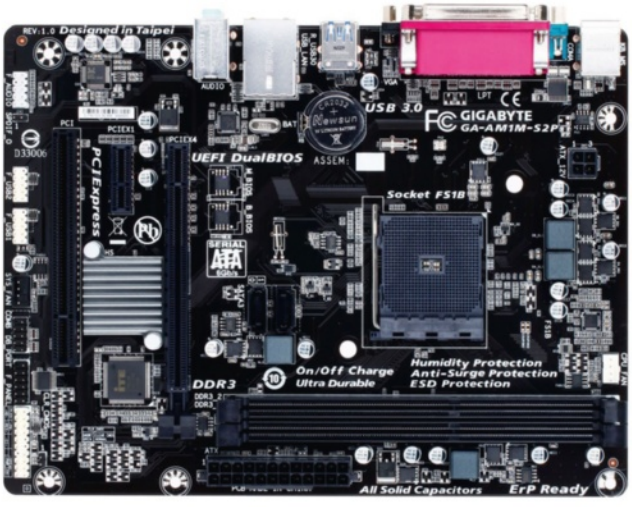
CHIPSET UPDATE REPORT

A GLIMPSE AT THE HIGH AND LOW ENDS



The new AM1 platform integrates SATA and USB.

We'll admit that we've been pining for a socket beyond AM3+, so we were in a tizzy when we heard from AMD that it had a new socket coming. Unfortunately, it wasn't quite what we expected. Behold the new AM1 platform, which is aimed at PC enthusiasts at the decidedly lower end of the spectrum.

Paired with the new sub-$60 CPUs, AM1 also brings a new Socket FS1B to the world. If you look closely at the picture of the Gigabyte GA-AM1M-S2P mobo, you'll notice very different features in AM1. Don't see it? Look closely at the SATA ports and where the traces go. Yes. The CPU, err, APU is the chipset. We've seen the CPU/APU eat the memory controller, PCIe, and graphics, and now even the lowly south bridge functionality for SATA and USB have been in-sourced to the CPU.

For the most part, this is a system on chip—except that it's in a socket. AM1 clearly isn't aimed at the multi-GPU, RAID 0 SSD, 4K surround, fire-breathing enthusiasts, but for entry-level users, it's an interesting proposal—it does offer some capability to upgrade that isn't available to bottom-end users. We've typically seen Atom-based systems with soldered-on processors down in this price range. For example, just after release, we could already find AM1 motherboards for as low as $30, while the rock bottom LGA1150 boards for the Celeron or Pentium parts were still pushing that luxury price of $50. What's next? Caviar for breakfast?

Performance enthusiasts may hold up their noses at AM1, but it does offer those in developing nations or those on shoestring budgets some modicum of upgradability they probably never had before. You could even, if you wished, drop in a discrete graphics board, although the expansion slot will only be running at x4 speeds. Not exactly great, but honestly, can we be that far away from Intel also introducing an SoC CPU, as well?

WHAT WE KNOW SO FAR ABOUT X99

Let's face it: The only thing "next-gen" about Z97 are a couple of glued-on M.2 and SATA Express ports. It's just Z87 in a new pair of shoes and dress. For those who want the red meat, that won't come until this fall, when Intel unleashes the X99 chipset for the upcoming Haswell-E CPU. You can read more about Haswell-E on the next page, but the point of note is that it's the Big Boy socket for the high-end enthusiasts.

Besides the DDR4 memory controller that the CPU brings, Haswell-E will support up to 14 USB ports—six of which can be native Intel USB 3.0 ports. For those who don't remember, the "Patsburg" peripheral controller hub on X79 didn't support native USB 3.0, relying on third-party USB controllers. X79 also fell short in SATA land, with just two SATA 6Gb/s ports and four SATA 3Gb/s ports. X99's Wellsburg should have 10 SATA 6Gb/s ports. What's not clear yet (publicly, anyway) is how SATA Express and M.2 will be implemented on the X99 chipset.

We do know that one issue with the 1,000MB/s limit on Z97 is due to the PCIe Gen 2.0 connection in the southbridge on the chipset. While there are PCIe Gen 3.0 connections on Z97 boards, those apparently cannot be used for M.2 or SATA Express without remapping of lanes on the motherboard and CPU. That likely won't be the case with X99. In fact, we've seen better performance from PCIe-based SSD's just by moving from Z77 to X79, so it's possible and likely that the 40 available PCIe 3.0 lanes (vs. 16 in the Z97 platform) can be used to make M.2 and SATA Express sing like they're truly supposed to.

With that fat load of PCIe lanes, X99, like X79 before it, will continue to be the platform of choice for those who need ass loads of PCIe bandwidth for storage or capture cards. X99 is publicly slated to debut at the end of this year, but all indications are that it'll be here well before autumn.

We mocked up an X79 chip as an X99—but don't worry, it'll still be 20 better when it's released.

CPU AND APU REPORT

EXPECT RED MEAT AND OVERCLOCKING

Intel's motivation to wrap its arms and legs around PC enthusiasts is driven by the most powerful emotion of all: profit. Enthusiasts, it turns out, love to buy desktop CPUs, and those unlocked "K" CPUs have been nothing but heart-shaped boxes of silicon for the company over the last few years.

It's with this in mind that the next 12 to 18 months will be glowing redder than a Cylon's back during an intense match of gaming. There's no less than four new CPUs coming out, all aimed squarely at PC enthusiasts. We'll break down what we know and what you need to know about Intel's upcoming lineup, and then also lay out what's coming beyond that. We'll also cover AMD's upcoming lineup, including the first socketable SoC design that we've seen.

DEVIL'S CANYON

The Church Lady may not have picked this codename, but it's clear Intel intends its summertime Haswell-refresh to be a bad mother. Devil's Canyon is basically a bionic version of the Haswell CPU, with its primary mission being overclocking. To do this, Intel is reworking the thermal interface material (TIM) and redesigning the CPU package to enhance it. Clocks and core count aren't detailed yet, but you can expect it to have a base clock the same or in excess of the fastest Haswell desktop parts out now. But with the emphasis on overclocking, we hope that Devil's Canyon will be binned and expected to offer overclocking more in line with what we saw in the LGA1155 Sandy Bridge days, when you could reliably hit 5GHz overclocks.

Part of that overclocking will come from the new TIM. Sandy Bridge parts overclocked higher and ran cooler than the Ivy Bridge that replaced it. Haswell didn't improve the situation, either. Many believe the reason for the higher temps and lower overclocks in the LGA1155 and LGA1150 parts is due to the switch from fluxless solder to a lower-cost material. Others blamed the smaller die area from the smaller process, while some believed some CPUs simply had poor applications of the TIM. Intel officials we've spoken to have said solder wasn't the reason—it was simply the hand you're dealt when CPUs are primarily designed to run in laptops.

Perhaps one sticky issue for Devil's Canyon is whether it will work in existing 8-series chipset boards. The official word is that it's supposed to only work in 9-series boards, but since it's basically Haswell, motherboard vendors will likely "make it work." That won't be the case with Broadwell, though, which you'll read about shortly.

PENTIUM K

Officially, Intel is calling its new Haswell-based Pentium the "Pentium Anniversary Edition" to celebrate 20 years of the Pentium brand. Unofficially, we've taken to calling it the Pentium K. That's because this chip seems to be aimed squarely at the budget DIYers and gamers who don't need nor want to pay for a pricey Core i7 or even Core i5 processor. Instead, these cheap bastards (God bless 'em) like to take the low chips and over clock the bewhosits out of them. For the last few years, these budget overclockers have all turned to AMD, which offers unlocked parts for as little as $62. Intel lovers, however, only had two unlocked "K" parts in either Core i5 or Core i7, the cheapest of which has always been about $230.

That's what we know, publicly. What we don't know is what exactly the configuration of Pentium K will be. Dual-core? Quad-Core? Low-clock, high-clock, small cache? It's all speculation at this point, but our educated guess is that Pentium K will be a dual-core, Hyper-Threaded part with Turbo Boost. Four years ago, Intel offered a similar chip for the LGA1156 platform. Like the LGA1156, the Core i5-655K was also short-lived, but a part like this could offer budget overclockers a good option.

The last question is what will it cost. We don't know, but we have heard from vendors to expect to be disappointed, because it won't be as cheap as you might expect it to be. In our book, that means the first Pentium K parts may be more along the lines of $130 to $150.

HASWELL-E

For those who just can't live with a puny quad-core CPU, Intel's answer will be its first consumer eight-core CPU, code-named Haswell-E. The E stands for Enthusiast and the chip will, as its name implies, definitely appeal to the upper crust of enthusiasts. Sandy Bridge-E, if you remember, is actually an eight-core chip with two of the cores permanently switched off at the factory. Intel has offered eight-core versions of it, but branded as Xeon chips. Haswell-E will also usher in the DDR4 era with its quad-channel support for the new memory standard. Haswell-E will ride in the LGA2011-3 socket. And no, that doesn't mean you can slot one into your old X79 LGA2011 board, or put your existing LGA2011 Sandy Bridge-E into a new X99 board. While both feature the 2011 nomenclature, they are incompatible. In fact, looking at the leaked image of the Haswell-E CPU, you can see the new chip has a larger "wing" design on the heat spreader that aids clamping down the CPU in the socket. The launch clock speeds and cache sizes aren't known yet, but the top-end Extreme version will be unlocked and we expect the price to slot into the typical $1,000 range for the big kahuna version. With the move to a true eight-core CPU, we're hoping that Intel will give us a $500 eight-core version and a $300 six-core version. With Ivy Bridge-E and Sandy Bridge-E, the $300 models were quad-core chips and really didn't offer that much over their counterparts in the LGA1156 and LGA1155.

Photo Credit: VR-zone.com

Though it fits into the LGA2011-3 socket, Haswell-E will not work in existing LGA2011 boards.

BROADWELL K

The final surprise CPU that's coming either very late this year or very early next year is the Broadwell K. Broadwell is essentially the 14nm die-shrink of Haswell. Originally, Intel had no plans to offer Broadwell in a socket, which caused the Internet to again proclaim the desktop PC dead. Apparently, pushback from its customers has convinced the company to release an unlocked Broadwell CPU in LGA1150 trim. The chip will actually require a 9-series motherboard, but what it offers isn't known. In fact, we're confused as to what the CPU will offer at all for desktop performance users, since it was always intended as a mobile or small-factor chip.

In a surprise move, the next-gen 14nm Broadwell CPU will come in a socket after all.

SKYLAKE AND SKYLAKE-E

The final two desktop parts you should expect in the next year or more is Skylake—the follow-on to Broadwell—and Skylake-E. Skylake will bring out a new socket and chipset to go with its DDR4 memory support. Skylake-E, of course, will be the enthusiast version, and the skies the limit there. Perhaps a 10-core enthusiast chip? We can hope, can't we?

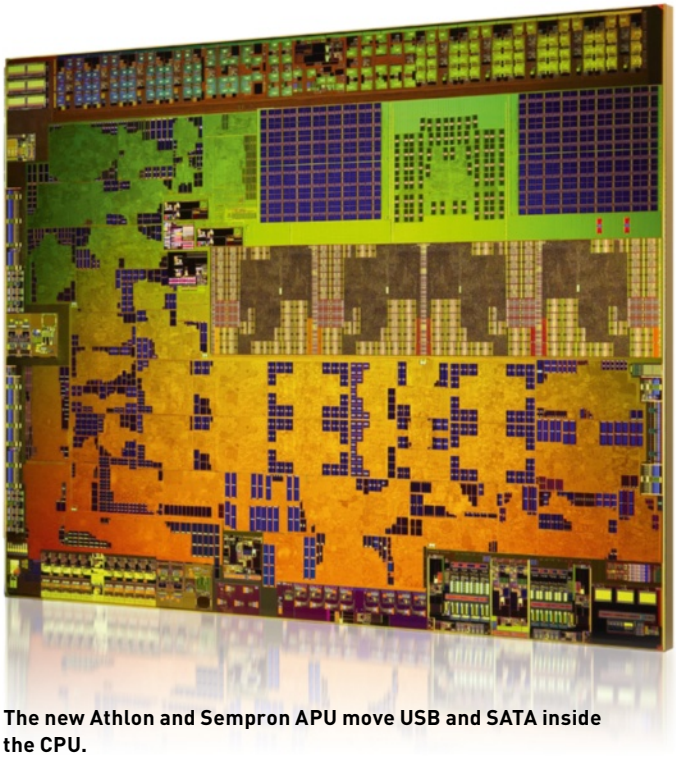
YES, AMD STILL MATTERS

As mentioned earlier, the AM1 platform is introducing a socketable system on chip for ultra-budget "enthusiasts." So yes, AMD partisans do get some love this year from the company, although it's certainly not in the high-end. AMD has dusted off the Athlon and Sempron brands and introduced a new extreme-budget APU platform called AM1. AM1 is intended to give those who typically get ARM or Atom-based SoC computing power "enthusiast" options, such as upgradability. Four AM1 APUs will ship at launch, with the top-end slot going to the 2.05GHz Athlon 5350 part. This is a quad-core part using AMD's Jaguar cores. For graphics, the Athlon 5350 will use AMD's GCN architecture with 128 cores and up to 600MHz clock speeds that the company is calling Radeon R3 graphics.

In size, the new Jaguar cores are tiny. AMD says four of the Jaguar cores will fit into a single Steamroller dual-core module that was used in the FX lineup. Despite the socket, the chips are actually APUs with southbridge functionality, such as USB and SATA, rolled into the die. While we didn't have one to test, AMD claims the Athlon 5350 should offer significant gaming performance over Intel's Pentium J2900 parts, or even a Celeron G1610 with a $25 graphics adapter attached. The chips themselves will be damned cheap. The Athlon 5350 will come in at $59 versus the $94 Intel wants for the Pentium J2900. The lowest-end part is the dual-core 1.45GHz Sempron 2650 that has the same amount of GCN graphics cores but runs the GPU clock down at 400MHz. With AM1 motherboards as low as $30, it's possible to build a functional (but certainly not rip-roaring fast) PC for under $200.

CARRIZO

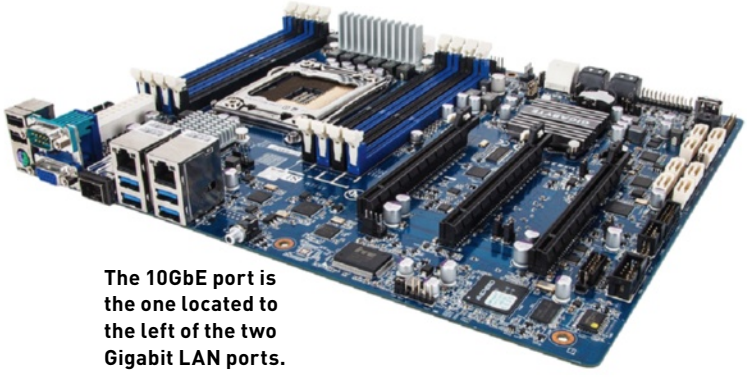
With AM1 taking the low end, AMD will expect its Carrizo to carry the battle with Intel. Unfortunately, Carrizo won't take to the field until 2015. The public details of Carrizo known so far is that it's an FM2+ part and will use AMD's new Excavator cores with GCN graphics cores. Leaks on Carrizo indicate the APU could very well feature support for DDR3 and DDR4. Presumably, AMD would enable DDR3-only initially, as FM2+ motherboards can't support DDR4. Once DDR4 is more affordable and mainstream, the company could introduce an updated socket with DDR4 support. Like AM1, Carrizo reportedly integrates some limited USB and SATA controls into the core—but that functionality will only be enabled in mobile platforms. In a more traditional desktop configuration, the chip would rely on the motherboard's SATA and USB to handle the duties. And no, sorry, there's still no word nor signs that we will see a successor to the FX or Phenom II.



The new Athlon and Sempron APU move USB and SATA inside the CPU.

WHY THE DELAY?

WE TRY TO GET TO THE BOTTOM OF THE DELAY ON THREE PROMISING TECHNOLOGIES



The 10GbE port is the one located to the left of the two Gigabit LAN ports.

10GbE

We can still remember the Intel Developer Forum presentation from four years ago that said 10 Gigabit Ethernet on consumer motherboards was just around the corner. Well, it's been one hell of a corner. In fact, here we are, still without any 10GbE on consumer boards. Why the hell not? The obvious reason is cost. While the Realtek or Intel networking chips on your motherboard might ring the register at two bucks, a third-generation Intel 82599EN 10GbE controller is $74—and third-party controllers aren't much cheaper. The other reason is, why bother? Mainstream consumers have no love for wired connections, so there's little incentive to bring down prices. The lack of devices in the home that actually need that kind of bandwidth also makes 10GbE a long shot for consumer motherboards. There is hope, though. Gigabyte's new GA-PXSVT was just introduced. It's intended for servers and workstations, but the board is a single-socket LGA2011 motherboard with 10GbE.

DDR4

DDR4 modules have been on display for at least three years now, and the spec was completed two years ago, but no PC chipset has been made to support it. Those up on current events know DDR4's time will come this year when Intel unveils Haswell-E, but many have wondered what the delay has been. The answer is complicated, but many blame the slowdown in PC sales, the emphasis on mobile devices (and we don't mean laptops), and the belief that the industry won't be able to rake in the massive profits that initially come when new memory standards are pushed. RAM makers have also been resistant to make memory that won't fit any current configurations. Intel and AMD, meanwhile, don't make chipsets/CPUs for memory priced high enough to crater sales. Basically, no one has wanted to put their head on the chopping block first. Well, until this year, anyway.

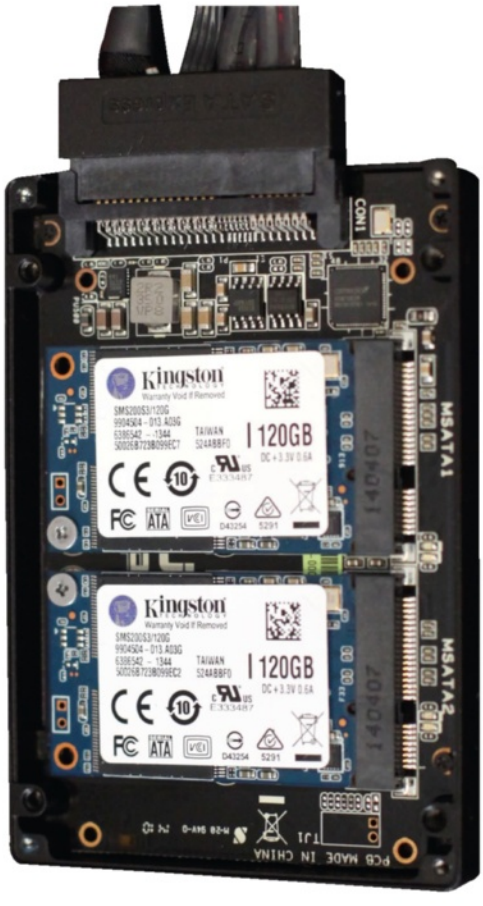
A DDR4 engineering sample sits atop the three previous generations of DDR.

SATA EXPRESS DEVICES

SATA Express is here. We know, because we've held the motherboards with the ports. So, where the hell are the devices? Nowhere that we know of. In fact, the lack of SATA Express devices apparently almost caused Intel to scratch support for the interface in the 9-series chipset, since there were no devices to test with. Asus even came up with a SATA Express drive that pairs two mSATA drives in RAID 0 with a SATA Express connector as a workaround for consumers.

The reason? Likely the lack of controllers and test boards is behind it. That should change now that 9-series boards are out, but we don't expect SATA Express drives to really hit until the end of this summer.

Asus Hyper-Express drive is an attempt by the company to bypass the dearth of SATA Express drives.



THE FUTURE OF VR

WHY YOU MAY NEVER NEED TO GO OUTSIDE AGAIN

You know something's on the right track when every time you see a product in development, it just gets better. That's why, despite the hype, Oculus Rift seems to be the most promising virtual reality technology yet.

The latest version, the Oculus Rift Development Kit 2, ups the ante with a 1080p, 75Hz, low-persistence OLED panel. The DK2 also offers positional tracking via an external camera, which allows you to lean into virtual objects.

While we don't know when the final retail version will release, we did have a chance to speak with Oculus VR founder Palmer Luckey at PAX East, where he told us that the company will be targeting an even higher-resolution display and a 90Hz refresh rate panel for the consumer version. Valve, which has helped Oculus quite a bit along the way, has found in its copious VR research that to achieve "presence," or the feeling that you are being swept up in a virtual environment, a 90Hz refresh rate or higher is required.

There are many other technical obstacles that the Oculus Rift faces before becoming truly immersive. Even with the more refined DK2 unit, it's still a long way off. Regardless, we're confident the technology will get there eventually. And whether you love it or hate it, Facebook's acquisition of Oculus has a massive part in all of this. Luckey told us that prior to the buyout, Oculus had to rely "a lot on the scraps of the mobile phone industry," and that now with Facebook's backing, the company has the resources it needs to develop custom hardware that is optimized for VR.

VR headsets will eventually achieve the feeling of "presence."

What started out as a virtual reality headset geared for gaming has expanded into something much more ambitious. Luckey told us he believes that VR headsets will eventually replace traditional flat-screen monitors, and that it will become such a paradigm shift that it could disrupt the need for most of our in-person interactions. Maybe we'll never need to leave the house again.

NEXT-GENERATION GAME CONTROLLERS

LOOK OUT, MOUSE AND KEYBOARD, EVERYONE WANTS YOUR JOB

If mouse and keyboard had a mouth and arms, we know they'd be beating their plastic chest and screaming: "Top of the world, Ma!" Well, watch out mouse and keyboard—you're back in the crosshairs again. The most prominent device aimed at replicating the precision of the mouse and keyboard is Valve's own Steam Controller. In first-person shooters, one circular track pad mimics the free look while the other mimics WASD. Its track pads can be reconfigured to both act as the mouse, too, for RTS games where you have to scroll around quickly. The Steam Controller is expected to be sold both individually and bundled with the company's upcoming Steam Box game device. The controller originally was planned to include a touch-sensitive screen, but that feature has since been dropped.

Valve's intention isn't to replace the mouse and keyboard on a desk, though—its purpose is to make it possible to play PC games on a couch. Other companies are taking a run at the mouse and keyboard, with the most promising being the Kickstarter-funded King's Assembly. The device tries to improve on the mouse and keyboard by essentially combining both functions in one. Why? Ever get fragged while trying to quickly taunt someone via chat? With the King's Assembly, you'll be able to keep both hands on the keyboard and mouse, because they're the same device.

The King's Assembly actually combines mouse and keyboard into one.

Then there's the Aimpad. Also a Kickstarter project, the Aimpad uses specially design keys to simulate analog-like controls. Instead of the on/off states of digital keys, the Aimpad's keys measure the height of the keypress. In theory, this would give your fingers finer-grain control of when you pop out around a corner.

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AMD RADEON R9 295X2

EVERYTHING WE WANT IN A GPU

AMD—you so crazy. That's really the best way to summarize the dual-GPU R9 295X2 video card we're testing this month, and all of AMD's aggressive maneuvers over the past six months, too. First, it released the Hawaii GPUs at the end of 2013, which essentially tied Nvidia's flagship cards' performance, but for way less money. Then it announced it had designed its very own API named Mantle to compete with DirectX. And let's also not forget it won contracts to develop the GPU/CPU inside every next-gen gaming console, while its much larger competitor Nvidia is in exactly zero gaming consoles. Fittingly, AMD is starting 2014 with a bang, too, by releasing the dual-GPU monster card you see before you. Unlike all the previous dual-GPU cards the company has released, this one is the first card we've seen where the cores involved are actually clocked higher than they are on the single-GPU boards. It's also the first liquid-cooled dual-GPU card we've seen from AMD as well, making it a true one-of-a-kind GPU, with specs and a price tag way beyond anything we've seen from AMD before.

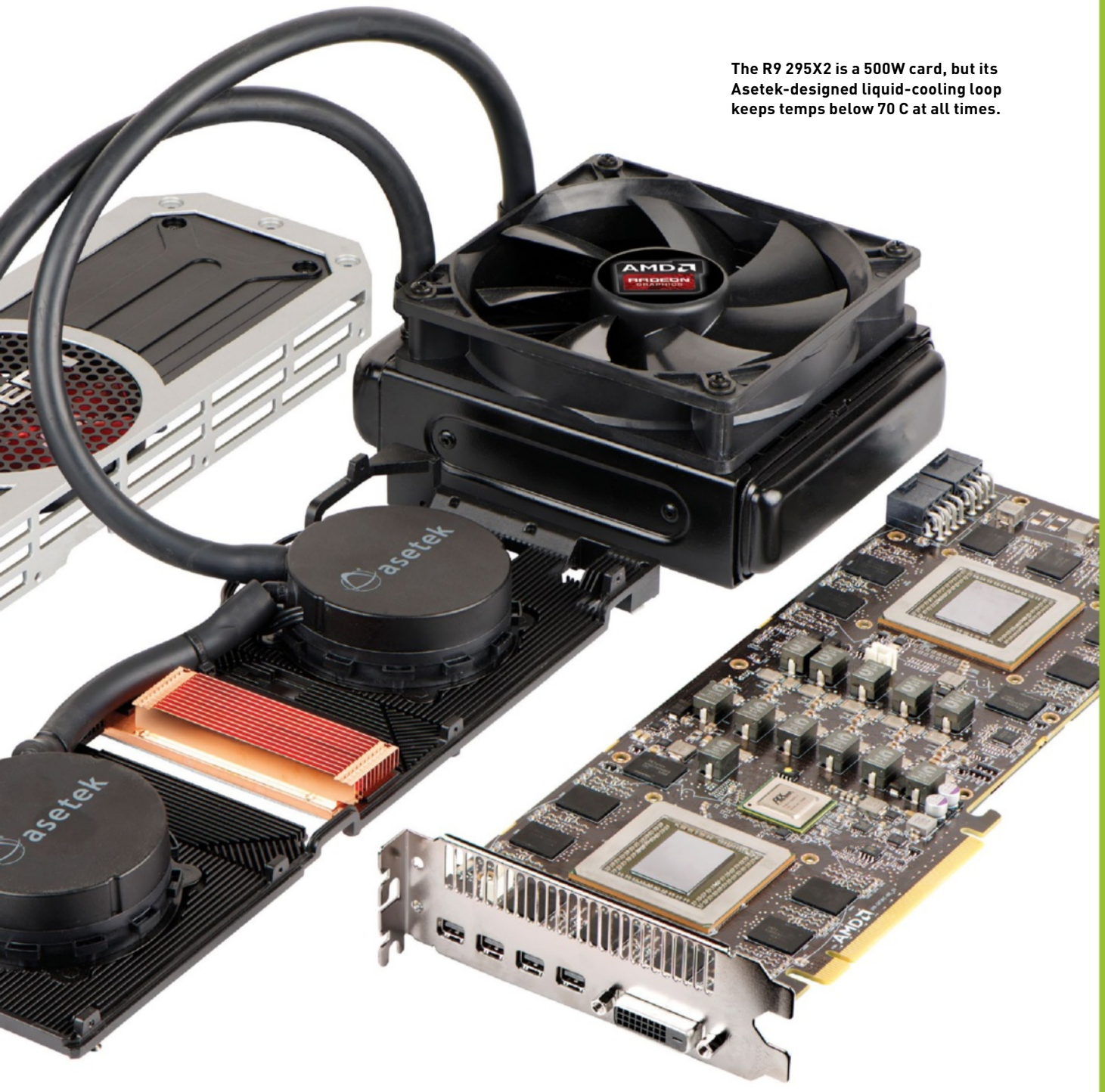
Dubbed the R9 295X2, aka Project Hydra, the card combines two of AMD's flagship R9 290X GPUs on a single 12-inch PCB with a PLX chip in between directing traffic. Since the R9 290X GPU is the hottest-running GPU available, you can imagine the herculean task of keeping two of them cool, especially when they are both running at full tilt. Trying to keep them both cool using traditional air-cooling would have been impossible unless the GPU took up four slots and used a fan large enough to pull night shifts inside a wind tunnel. In order to keep its size and temperatures under control, AMD enlisted the help of Asetek to design a maintenance-free closed loop liquid cooler for both GPUs, with the whole shebang attached to a 120mm radiator. The R9 290X cores used for this card are not only full-loaded in terms of specs and clock speeds, but since the card is liquid-cooled AMD has actually overclocked them a smidge.

To quickly recap the specs, the card has two fully-clocked R9 290X cores, with each running at 1,018MHz under load. The reference cards ran at about 925MHz under load due to heating issues, but the liquid-cooled GPUs in the R9 295X2 should run at full speed under load with no problemo. Each GPU core has 4GB of GDDR5 RAM clocked at 5GHz, 2,816 Stream Processors, 6.2 billion transistors, and the ability to throw down 250W of energy. As if all that wasn't enough, the price is equally jaw-dropping at $1,500—and though that seems steep, it comes on the heels of Nvidia announcing its own dual Titan GPU priced at $3,000, so AMD has a major price advantage over Nvidia at this time. We expect Nvidia to release a dual-GK110 card using two GTX 780 cores and call it the GTX 790, but as of press time no such card had broken cover.

So, the card certainly sounds promising but it all falls apart when it comes to benchmarks, right? It runs hot and loud, and is generally disappointing? Nope, nope, and nope. In fact, the card delivers on all its promises, runs cool and quiet, and set new benchmark records for a single card in every single test we ran. In a nutshell, it's the fastest single-card GPU we've ever tested, by a huge margin. Now, keep in mind we don't have a Titan Z GPU to test it against, nor do we have two GTX 780 Ti cards to run in SLI, which combined should cost a tiny bit less than the R9 295X2 and should outperform them, though they would run significantly hotter and be much, much louder. The R9 295X2 is surprisingly cool and quiet, never rising above 70 C for both GPUs even under continuous load, which is a miraculous engineering feat and we applaud AMD for its success in keeping this big dog muzzled.

Perhaps the greatest achievement of the R9 295X2 is it's the first single GPU we've tested that allows most of our testing suite to run at Ultra HD resolution (3840x2160) at over 60fps with all settings at their highest. In Battlefield 4, CoD: Ghosts, Batman: Arkham Origins, Far Cry 3, and Hitman: Absolution it achieved the magical 60fps mark, though more demanding titles like Metro: Last Light, Crysis 3, and Assassin's Creed IV: Black Flag still need more horsepower unfortunately, or you could crank the settings down a bit too. Also, in our testing we found it was exactly as fast as two R9 290X cards in CrossFire, and since those are about $600 each in aftermarket trim, you could save yourself some cash by just taking that route for CrossFire.

All in all, the R9 295X2 is as perfect a GPU specimen as we've ever seen, and with just one caveat. It offers record-breaking performance in a single-card form factor, and does so while being chilly and relatively quiet, all at half the cost of its rumored competitor. If that's not a Kick Ass recipe, we don't know what is. It's a tiny bit expensive compared to what two cards cost, but that liquid-cooling setup certainly isn't cheap, so we're not terribly offended. Overall, if you want the fastest single GPU in the world, this is definitely it.



The R9 295X2 is a 500W card, but its Asetek-designed liquid-cooling loop keeps temps below 70 C at all times.

VERDICT 9 KICK ASS!

AMD Radeon R9 295X2

$1,500, www.amd.com

TITAN Zzzz?

OVERPOWERED AND OVERPRICED

Ever since the launch of Nvidia's GK110-based Titan GPU and the subsequent GTX 780 and GTX 780 Ti, we've been wondering when the company would stuff two of them onto a single PCB. We got the answer to this question at Nvidia's GPU Technology Conference, where CEO Jen Hsun brandished a massive GPU nobody had ever seen before named Titan Z. The first details were jaw-dropping—12GB of RAM, 5,760 CUDA cores, and a price tag of $3,000. "Damn," we said to ourselves, "that is one ridiculous graphics card." Jen Hsun himself said it was designed for those "in desperate need for a supercomputer that you can fit under your desk," while Nvidia would later claim it was designed for 5K and multi-monitor gaming.

The card features two fully enabled GK110 cores, otherwise known as Titan Black. This means it has double of everything Nvidia is currently capable of offering in a GPU, so just like the Radeon R9 290X this card has cut no corners whatsoever. It has every SMX unit enabled in both GPUs for a total of 2,880 CUDA cores each, and 6GB of 7GHz GDDR5 for each GPU too. The only unannounced spec as of press time were its clock speeds, but the Titan Black runs at 889MHz base clock and 980MHz boost clock, so we'll have to wait and see if both GPUs can match those clock speeds or not. Nvidia mentioned it's implementing a new (to us) load-balancing algorithm that lets both GPUs always run at the same speed, which helps ensure one GPU doesn't become a bottleneck by throttling itself due to heat.

The Titan Z takes up three slots, thanks to its chunky air-cooling apparatus.

Given its ridiculous price tag, we imagine this card will only appeal to developers and those who need its compute performance. Any rich gamer who buys this over two GTX 780 Ti cards needs to have his or her head examined.

THE API WAR HEATS UP

NVIDIA BATTLES AMD'S MANTLE API

AMD raised a lot of eyebrows in late 2013 when it introduced its new Mantle API as a competitor to the long-standing king DirectX. AMD reasoned that since DirectX was designed to work with any type of hardware on the market, it was inherently inefficient, meaning PC gamers weren't able to benefit from the same level of optimization that occurs on the consoles where developers code games to run on a specific hardware config. That's a logical argument, and is just the nature of the PC gaming beast, really. We have a lot of hardware, varying from a GTX all the way down to Intel integrated graphics, so DirectX makes sense because it works with everything. That said, when AMD mentioned its Mantle API could deliver up to ten times the number of draw calls from the CPU to the GPU, interest was piqued. Several months later, Mantle launched, and having tested it, we must say we're a bit underwhelmed.

You see, Mantle helps the CPU send more calls to the GPU, but if you've already got a jacked CPU, it doesn't really need any help, so it's barely noticeable in most games when using a decent proc. In AMD's own words, "Mantle enables a pronounced improvement for the majority of PC gamers that have entry-level and mid-range processors." Well that's not us, and as of press time, Mantle support was only available on two games, and three AMD GPUs (R9 290X, R9 290, R7 260X).

Despite Mantle's shortcomings, Nvidia felt compelled to respond, and did so with its 337.50 Beta driver, which it claimed offered, "up to 64 percent faster single GPU performance" as well as "up to 71 percent faster SLI performance." Those are big claims, and in testing we found it was akin to Mantle in that it only showed gains in specific titles on a mid-range build. Also, the games it improved were Mantle-enabled games like Thief and Battlefield 4.

Thief is a Mantle and DirectX game that has become the new battleground for driver optimizations.

Going forward, both AMD and Nvidia will continue to optimize their drivers, but we're calling this a stalemate for now, as neither side holds a significant advantage when it comes to driver optimization.

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It's entirely possible to run rampant through a minefield without blowing yourself up, but do you really want to risk it? One wrong move or accidental step will have you forever regretting that decision. There are strategies you can employ that will lessen the chance of setting off an explosive, but unless you have a blueprint of the entire landscape, your luck is bound to run out at some point.

Surfing the web without antivirus protection is similarly risky. You may think you're playing it safe by avoiding shady websites and staying away from illegal downloads, but you can't avoid danger entirely. Even if you do everything right, the security practices of other users and websites are out of your control; should a legitimate website become compromised, it could serve up malware to unsuspecting visitors. Likewise, a family member could unwittingly send you an infected file. While you're sipping your morning latte singing "Everything is Awesome," some black-hat teen in Russia is busy selling your stolen info on the underground market. Good luck explaining your situation to all three credit bureaus. In less dramatic fashion, you could simply end up with an infected PC that putters around like a beat-up truck with sugar in the gas tank.

The alternative is to supplement your safe computing habits with security software. There are many suites available, so we rounded up 10 of the most popular AV applications—seven that cost money, three that are free—and ran rampant on the web to separate the contenders from the pretenders.

ANTIVIRUS BATTLE ROYALE

WHICH OF THESE 10 AV CONTENDERS DESERVES A SPOT ON YOUR PC?

BY PAUL LILLY

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MAKING THE GRADE

PERFORMANCE IMPACT AND SCAN TIMES

Maybe 100 years from now, installing security software will actually speed up performance. We're not there yet, so evaluating the performance hit of each AV program still factors into our verdict. To gauge this, we record startup times and how long it takes to transfer large and small files. We also collect scores from PCMark 8 (system) and Peacekeeper (browser). All results are compared to a clean installation with no AV software, which we revert back to in between installing AV programs using Acronis True Image ($50, www.acronis.com). Full system scan times also affect scores.

ANNOYANCE LEVEL

Imagine hiring a bodyguard to follow you around, but instead of warding off muggers, he screams "Danger!" each time you walk past a dark alley. And when real danger *does* present itself, rather than jump into action, he freezes up until you tell him what to do. We've seen some AV programs act like that. AV software should take action on its own when there's a real threat, and false positives should be kept to a minimum. We also don't want to be badgered into purchasing additional protection.

FEATURES AND IMPLEMENTATION

Seven of the 10 AV programs in this roundup are fleshed-out security suites, which give them an immediate advantage over the three free programs in this category. However, it's not that cut-and-dried. We're not adding up bullet points and giving higher scores to the programs with the most features. Instead, we're on the lookout for features that we'll actually use, along with how well they're implemented. For example, a virtual keyboard that dodges potential keyloggers is great for signing into banking sites, but if we have to spend 10 minutes searching for the option in a convoluted menu layout, then we'd rather risk using our hardware keyboard.

PRICING AND VALUE

While full-fledged security suites have an inherent advantage in terms of features, the free security programs own this category. The onus is on the seven other security suites to convince us the additional layers of protection and added amenities are worth paying for when free protection is a mouse click away.

MALWARE DETECTION

To ensure we do this category justice, we not only run our collection of tests—visiting infected websites and attempting to load malware samples—we also take into consideration the results of three independent testing labs: Virus Bulletin (www.virusbtn.com), AV-Test (www.av-test.org), and AV-Comparatives (www.av-comparatives.org). Going this route paints a broader picture of protection than we're able to test on our own.

BITDEFENDER
INTERNET SECURITY

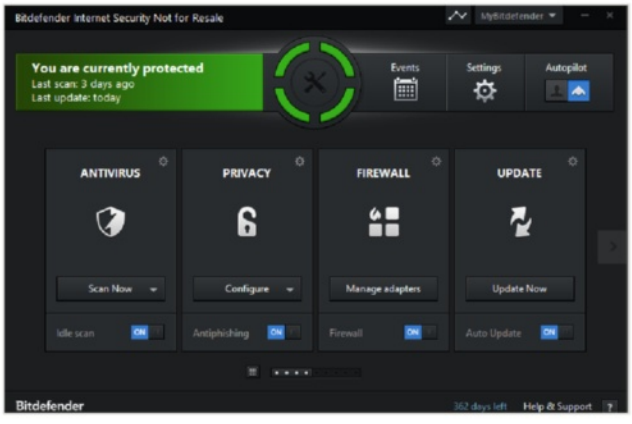
Unobtrusive and unforgiving protection

LET'S GET STRAIGHT to the point—Bitdefender lays the smackdown on malware like it has a personal score to settle, but like any good hitman, it goes about it without drawing attention to itself. The high level of effectiveness is what makes Bitdefender's Autopilot mode a feasible option. When engaged—you have the option of turning it on during installation—Bitdefender mans the controls and silently takes out threats as you stumble across the web. There are no pop-ups asking for your permission to take out a target, just lethal protection against menacing malware.

Even with Autopilot mode turned off, Bitdefender isn't bothersome. We actually prefer to leave Autopilot disengaged so that we know when we just stepped on a mine, but either way, Bitdefender offers the same high level of protection. It blocked nearly all of our attempts to sneak malware onto our system, and even when we did manage to download and install a malicious program, Bitdefender detected something was amiss and scrubbed our testbed clean.

Our results aren't unusual. Bitdefender has passed every single VB100 comparative test by Virus Bulletin since August 2010, and in AV-Test.org's latest report, it scored perfect marks across the board (Protection, Performance, and Usability). Out of nearly more than 19,600 malware samples deemed widespread and prevalent by AV-Test, Bitdefender nabbed them all.

Bitdefender's interface is easy to navigate and somewhat friendly for touch operation, for those who care. We also like that it includes a built-in file shredder, allowing you to permanently delete files. All of this security goodness weighs on the package—it takes up a bit more space than most AV programs, and we sometimes noted longer boots and file-transfer performance. We're not too harsh on this simply because you're not likely to notice the impact without a stopwatch.



Turning on Autopilot mode allows Bitdefender to man the controls without ever having to ask for your input.

VERDICT 9 KICK ASS!

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KASPERSKY
INTERNET SECURITY 2014
More of the same from a familiar face

HAVING CONSISTENCY in the AV space can be a double-edged sword. What do we mean by that? Whereas some security programs look and act drastically different each year, Kaspersky seems to have found a formula it's comfortable with and is sticking with it. That's great for the things that work well, but it also means the same blemishes go unattended.

The user interface looks the same as it did last year and the year before that. If you're rocking a fancy hybrid laptop with a touchscreen display, you'll appreciate being able to tap dance your way through the menu system, which features large controls. Getting where you want to go isn't always intuitive, though the most common actions you're likely to perform are easily accessible.

Kaspersky's scan engine continues to run down malware like a demolition car, though it sometimes takes a moment to kick into gear. Rather than create a roadblock for dirty files, Kaspersky will often let an infected file reach the desktop before running it over and sending the infected code to the digital graveyard.

We found Kaspersky's detection rate to be nearly on par with what independent third-party testing labs report, though it did let a potentially unwanted program (PUP) lock our mouse cursor into a small box on the desktop. It took a bit of persistence (and Safe Mode) to undo the damage, but we eventually got rid of the offending program. We'd also like Kaspersky to rely less on our input when it finds a threat and take decisive action on its own.

Gripes aside, Kaspersky offers effective protection. It also bundles welcome extras like a virtual keyboard to evade keyloggers, a rescue media builder in case things go really wrong, and a vulnerability scanner to see if any programs present a security risk.

Kaspersky's interface is equally suited for mouse and touch controls.

VERDICT 8

Kaspersky Internet Security 2014

$80 (1 Year, 3PCs), http://usa.kaspersky.com

NORTON
INTERNET SECURITY
Lightweight protection that beats up malware like a heavyweight boxer

SYMANTEC DROPPED the yearly designation for its Norton product line, so instead of Norton Internet Security 2014, it's now simply Norton Internet Security (NIS). This change doesn't affect current or future subscriptions—you're always eligible to download the latest version of NIS as long as your subscription is current.

This born-again AV continues to atone for its sinful past. Power users still find this hard to fathom, but ever since Symantec rebuilt NIS from the ground up in 2009, it's been one of the better security products on the market. It installs in under a minute, is lean on system resources, and pounces on malware like a hungry cat chasing a three legged mouse.

We didn't have as many third-party reports to lean on for NIS this year as we normally do, so we threw some additional infected files of our own into the mix. Anytime we managed to evade the scan engine, NIS's SONAR technology would spring to action and zap our malware based on whatever suspicious activity it detected (precisely as SONAR is designed to do).

NIS leaves very little room to nitpick. If we were in charge of the program's development, we'd add a virtual keyboard for logging into sites like banking institutions, and we'd clean up the basement levels of the menu interface. The sleek UI is only skin deep—as you crawl through the options, the menu takes on a different look. It's also tailored more towards savvy users, which could be a turn-off for some people.

In addition to a two-way firewall and intelligent spam controls, Symantec bundles in a deep-scanning utility called Power Eraser for stubborn infections, and a Safe Web scanning app that combs your Facebook feed for malicious links. It's nice to have these baked in, though they're both freely available to everyone.

There are a lot of settings for power users to play with, though less-savvy users are better off leaving things alone.

VERDICT 9 KICK ASS!

Norton Internet Security

$80 (3 PCs, 1 Year), http://us.norton.com

PANDA
INTERNET SECURITY 2014
Trying a little too hard to fit in

WHEN YOU START hanging around a new group of people, you might change your style to blend in with your peers. So it goes with Panda Internet Security 2014 and Windows 8/8.1. Panda didn't just take a page from Windows 8's design scheme, it swiped the entire playbook and then gave itself a dramatic makeover. The result is that Panda's interface is a natural extension of the Modern UI in Windows 8, which bodes well if you're a fan of the design.

Unfortunately, it appears the developers spent more time dressing up Panda and not enough time teaching it tricks. For example, Panda includes a set of parental controls, but they lack even basic scheduling options. What's even worse is they don't support Internet Explorer 11, the latest version of IE introduced with Windows 8.1 earlier this year. To be fair, Panda is working on fixing this and it might even be compatible as you're reading this, but for now, it's a glaring omission for a security suite that's trying so hard to fit in.

Panda's lumbering scan engine is also a mixed bag. There's no sense of urgency in performing a full-system sweep, and not much time is shaved off when running subsequent scans. This is in stark contrast to most other AV programs that skip over files that haven't changed since the last scan. To Panda's credit, it caught most of our malware, and it scores well with the labs we check in with. However, we did manage to trip up Panda a few times, though in almost every case, it eventually picked itself up and figured out that something was wrong. One thing that likely helped in these cases is that we enabled Panda's TruPrevent option. This gives Panda the green light to analyze the behavior of programs and is essential in catching unknown threats that haven't yet been added to its virus database. Ideally, Panda would enable this option by default.

We like that Panda includes a virtual keyboard, which makes it more difficult (not impossible) for hackers to steal your login information with a keylogger. Panda also includes built-in backup software to automatically back up files to the cloud or local storage on a set schedule—nothing earth-shattering, but a welcome add-on.

Overall, Panda does a decent job of standing guard against malware, but there are other suites that do it better.

Panda's resemblance to Windows 8 is uncanny (and intentional).

VERDICT **7**

Panda Internet Security 2014

$70 (3 PCs, 1 Year), www.pandasecurity.com

WHAT'S THE DEAL WITH ADWARE?

If you've ever been called upon by a family member or friend to clean up their PC, then you've undoubtedly seen what a horrific mess bundled adware can have on a system. Toolbars and hijacked searches are common aftereffects of what happens when a person doesn't pay attention to the fine print, and so are random pop-ups and other types of cruft. They're not only annoying, but they can impact performance, too. With that being the case, have you ever wondered why many antivirus programs leave adware alone?

Unfortunately, the onus here falls on the end user. In many cases, they agreed to be bombarded with advertising when they installed a particular program. One way a developer can offer his or her program for free is by bundling in adware, and usually there's an option to not install the supplementary software. However, it's not always obvious—we've trained ourselves to skip over fine print and boring legalese. Still, it would be unscrupulous for AV programs to remove adware that a user agreed to install in exchange for a free application. It's unfortunate, but it's the way it is.

Not all types of adware play by the rules, and perhaps you never agreed to install a toolbar, yet there it is. While your AV software might not detect it, there are other security programs that will. It's a good idea to scan your system every so often with a program like Malwarebytes (Free, www.malwarebytes.org), which won't interfere with your AV.

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*Product features may vary by model. *Motherbaord models may vary based on local distribution.

MCAFEE
INTERNET SECURITY 2014
Turning over a new leaf

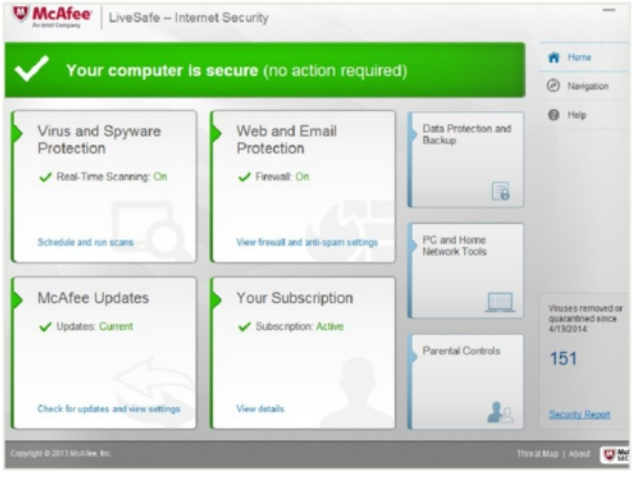
MINUS A FEW missteps here and there, McAfee's been on the verge of breaking into the ranks of one of the top AV solutions. That may sound like malarkey to old-school PC users who have spent hours uninstalling bundled McAfee software on systems belonging to family and friends, but one of the advantages to running these roundups is we get to see how a program evolves over time. What we've witnessed is a transformation from a lumbering and lethargic AV into light-footed security. However, the level of protection hasn't been up to our standards, until now.

We threw potentially unwanted programs (PUPs), Trojans, drive-by downloads, and an assortment of other malware at McAfee. Unlike in years past, we couldn't sneak anything by McAfee's on-demand scanner. We checked with a few AV testing labs and are confident that our experience is the norm, not the exception.

That isn't to say that McAfee's perfect. Pop-ups alert you when something foul is detected, but McAfee does a poor job providing details on the threat. We'd be willing to overlook this, except McAfee makes it a little too easy to bypass its recommended course of action. In our opinion, security software should either be decisive and neutralize a rogue file, or give us enough information to make the proper choice ourselves.

McAfee's interface isn't sexy, though it is functional and tuned for touch. It's also a little slow to react at times, such as trying to cancel a scan. It doesn't affect the entire menu, but there are definitely instances of lag.

There's quite a bit included in McAfee's security suite—a file shredder, network traffic monitor, vulnerability scanner, and miscellaneous tools to help justify the price tag. To the point, this is the best version of McAfee yet, though there's still room for improvement.



McAfee's interface won't win any beauty pageants, but it's mostly easy to navigate and friendly for touch.

VERDICT **8**

McAfee Internet Security 2014

$80 (3 PCs, 1 Year), http://home.mcafee.com

ESET
SMART SECURITY
An effective antivirus for nerds and newbs alike

SHELDON IS often seen playing on an Alienware laptop in *The Big Bang Theory*, and if he has antivirus software on that thing, it's probably ESET Smart Security. It's a nerd's paradise. You could spend an afternoon frolicking through the advanced settings and fine tuning ESET to your liking. On the flipside, there's nothing forcing you into the deep end—the main window offers access to the most commonly used functions.

Underneath it all is a scan engine that takes out malware with extreme prejudice. Our modest collection of foul files never stood a chance, and it didn't matter how many intentionally wrong turns we took on the web, ESET never stopped watching our six. Our experience jibes with the major testing labs—ESET collects VB100 award from Virus Bulletin like it has an addiction.

Like most other modern security software, there was only a negligible performance impact. File transfers took ever-so-slightly longer on our Windows 8 testbed; if you're rocking an older system, the performance hit might be exacerbated, but overall it's a fairly lean and efficient AV.

ESET includes anti-theft protection. With so many users going mobile these days, this could prove an invaluable tool. Once you report your device stolen, you can track its whereabouts, receive webcam pictures, and send a message to the screen.

Another feature that good-hearted geeks will appreciate is being able to send files to ESET. These can be malware samples that the scan engine missed, or false positives.

We don't have a ton to complain about. The interface is due for an overhaul, there's no time-management option in the parental controls, and the anti-spam feature hasn't worked with Thunderbird since version 5—boo! These gripes don't detract from the overall package, though they do stand in the way of a Kick Ass award.

Savvy users will appreciate the wealth of submenus and options at their disposal.

VERDICT **9**

ESET Smart Security

$80 (3 PCs, 1 Year), www.eset.com

WEBROOT
SECUREANYWHERE INTERNET SECURITY PLUS
Reigns light and effective from the cloud

TAKE EVERYTHING you know about antivirus protection and security suites, roll it into a ball, and flush it down the toilet. Done? Now, let us introduce you to Webroot, which very well might represent the future of security. Webroot works on the assumption that today's threats come from the Internet, so rather than install a bulky suite and maintain it with product updates and security patches, Webroot works most of its malware fighting mojo from the cloud.

There is a small program to install, which takes all of a few seconds. If you choose the custom option, you can have Webroot generate a random name for itself to thwart malware that might try to block known security programs—that's smart thinking.

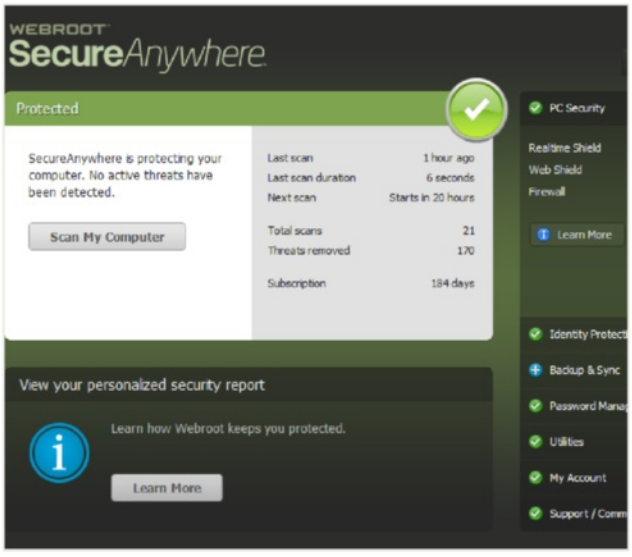
Once installed, Webroot scans your system, both to look for obvious signs of malware and also to take inventory of what's installed. From then on, Webroot sits idly by, waiting for malware to make the first move. When it detects a file doing something nefarious, Webroot blocks it from making changes, or rolls back any changes that might have been made when you weren't connected to the Internet.

What sets Webroot apart from other cloud solutions is that its online infrastructure was purpose-built to be its backbone rather than exist to supplement local definition scans. This allows Webroot to take up very little space, use fewer resources, and still remain effective—it's essentially a bigger, more robust cloud.

Webroot took pole position in full system scan times, though it missed some dirty files that were later detected when we directed it to focus solely on those files. This is the trade-off—Webroot won't necessarily clean your system of infected files during an initial sweep, but there's a good chance it will catch them when activated.

As a security suite, Webroot lacks parental controls or spam protection, and its outbound firewall serves as a supplement to the built-in firewall in Windows. However, you do get a password manager based on Lastpass, a built-in system optimizer, and a file shredder via right-click context menu. By default, the shredder only bypasses the recycle bin. To truly obliterate a file, you'll need to change the Secure Erase level to medium (overwrites with three passes) or maximum (seven passes).

Webroot is a bit feature-poor for a security suite, but it's also the cheapest of the paid packages. With a 70-day money back guarantee, what's to lose?



Don't let the local interface fool you, Webroot works its magic almost entirely from the cloud.

VERDICT **9**

Webroot SecureAnywhere Internet Security Plus

$60 (3 PCs, 1 Year), www.webroot.com

AVOID DRIVE-BY DOWNLOADS

Careful where you click on the web or you could get run over by a drive-by download. These are the web's equivalent of a hit-and-run, only they're entirely intentional and always intended to do you harm. The scary thing about drive-by downloads is that they come at you when you least expect it. You might have a favorite website that you visit every morning, but if that site is compromised by a hacker, that innocent looking ad banner or link to an article could serve up malware and you'd never know it.

It's best to err on the side of caution. Installing antivirus software goes along with smart computing habits as your top two lines of defense, but there are other steps you can take. One of the biggest is to make sure your browser plug-ins are all up to date. An easy way to do this is to use the BrowserCheck tool by Qualys (Free, http://bit.ly/MPC_Qualys). This handy tool will analyze your browsers and plugins, and then offer to fix any out-of-date software it finds.

We also recommend uninstalling or disabling Java if you don't have a specific need for it. There are still many applications that require Java, so this isn't an option for everyone, but unless you're one of those folks, this is just another potential path for malware to enter your system. The same goes for Flash. Firefox users can also install the NoScript add-on, which blocks JavaScript, Java, Flash, Silverlight, and other active content by default.

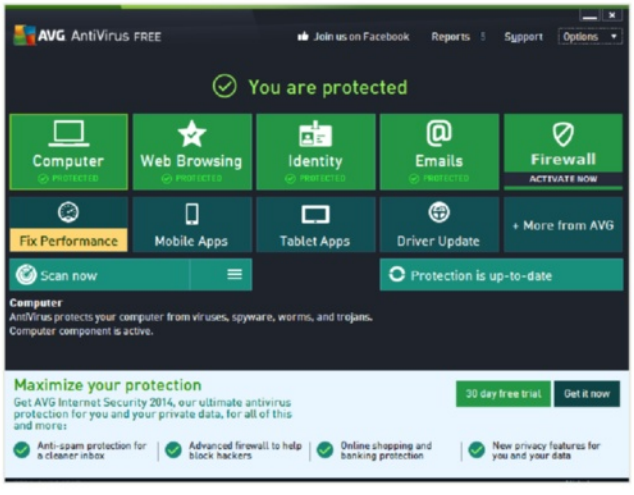
AVG
ANTIVIRUS FREE 2014
Pro bono protection for the cost of a sales pitch

YOU DON'T buy bottled water, you think extended warranties are a waste of money, and you sure as hell aren't going to pay for security software. Fair enough, we won't begrudge you any of those choices, but if you opt to install AVG Free for antivirus protection, get ready for a series of sales pitches.

Whenever you have cause to fire up AVG's dashboard, you'll see a banner ad imploring you to give the full Internet security suite a 30 day test drive. There's an option to hide the banner, but it's only temporary—the next time you load the dashboard, it's there again. AVG also teases freeloaders with locked options that are only available to paid users, such as anti-spam controls and identity alerts. Hey, AVG's developers have to eat, right?

What you do get is above-average malware protection with a surprising amount of configuration options. If you opt for AVG, we recommend spending some time going through the settings to make sure everything aligns with your expectations. For instance, AVG will scan for potentially unwanted programs, but there's an additional option for enhanced scanning that isn't checked by default. When enabled, AVG goes a step further by analyzing legitimate apps that might be misused or contain unwanted add-ons like toolbars. And if you're using an older PC—say, from the XP era—you should enable the "thorough scanning" option to look for older exploits and software flaws that don't apply to modern systems.

AVG caught the majority of our malware samples, though not all of them. This is in line with what AV-Test.org experienced, which rated AVG's performance a 4.0 out of 6.0. Assuming you're not spending the majority of your time in the web's dark alleys, AVG should keep you safe, but there are better options.



AVG's dashboard is littered with options that you can only use when you upgrade to the full-fledged (paid) security suite.

VERDICT 6

AVG Antivirus Free 2014

Free, http://free.avg.com

AVIRA
FREE ANTIVIRUS
A blueprint for free security

TO SAY THAT Avira is popular in the antivirus space is a gross understatement. According to Avira, over 200 million users around the world put their trust in its software. So should you, if you're looking for free security.

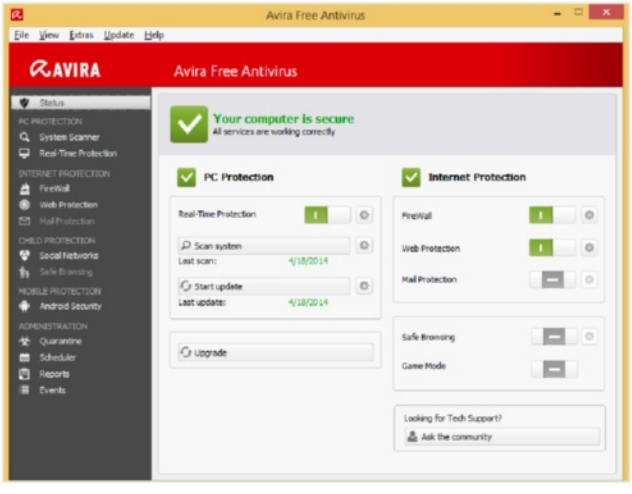
Of course, this isn't a popularity contest, though there are advantages to serving a large number of users. In this case, Avira has a large pool of users to draw information from regarding new and emerging threats, which are then stored in a database in the cloud. Unless you have the unlucky distinction of being the very first out of over 200 million users to stumble onto a brand-new strain of malware, there's a good chance that whatever evil lurks in the shadows will have already been cataloged.

This isn't just a theory of ours—Avira consistently scores high marks from third-party testing labs. In our own tests, Avira knocked nearly every harmful file unconscious, and in many cases it would follow up detection with a supplementary scan just to make sure no traces were left behind.

One thing Avira doesn't seem to do is skip over unchanged files during subsequent scans. Other AV programs use this technique to reduce scan times, and we're not sure why Avira doesn't.

Traversing Avira's menus feels a bit convoluted at first. If you spend enough time poking around, you'll feel better about your ability to drill down to an advanced option without any missteps, but who wants to spend time studying an AV software's layout? At least there's a fair amount to play with.

As with most freebie options, Avira lacks extra features like a two-way firewall, spam controls, and a game mode, which hushes the software when it detects you're playing a game. Still, this is our top pick for no-cost security.



Don't be fooled by the firewall option in Avira—it's actually just hooking into the Windows firewall.

VERDICT 8

Avira Free Antivirus

Free, www.avira.com

unmatched performance.

www.xidax.com

Starting at $799

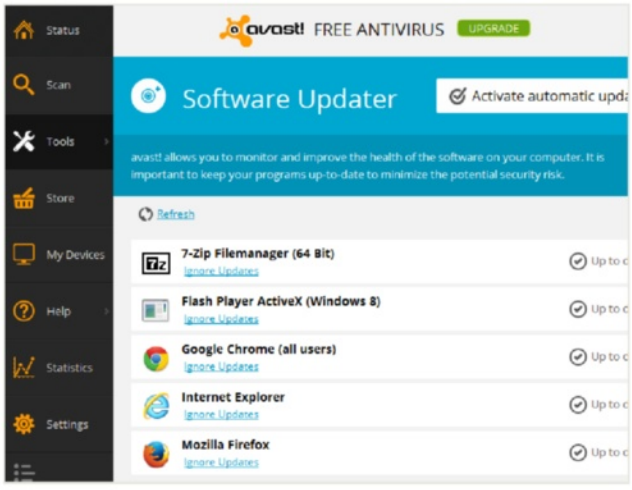
AVAST
FREE ANTIVIRUS
Slightly new look, same reliable protection

LIKE AVIRA, Avast boasts over 200 million installations on planet Earth—that seems to be the magic number in free AV. That's to say Avast is no Johnny-come-lately to the PC-protection party, though it does sport a slightly freshened-up interface that's a bit more streamlined compared to last year's release. Weaving in and out of advanced settings is mostly straightforward and logical, though it's a bit odd that Avast buries the update option in the Settings menu.

Avast doesn't scan for potentially unwanted programs (PUPs) by default. Even worse, the option to turn it on lies several menus deep (Settings > Active Protection > File System Shield > Sensitivity). Given that malware often piggybacks on top of seemingly legitimate programs, Avast should at least give users the option of enabling PUP protection during installation.

Only one of our malware samples went undetected during a system sweep. Avast also did a good job blocking access to harmful websites, though we were successful in downloading an infected file. This doesn't concern us too much, considering how many sites and downloads we put these programs through, and for the most part, Avast does well in third-party testing, save for AV-Test.org, which notes a below-average score in detecting zero-day malware attacks.

While the free version of Avast doesn't include amenities like a firewall, spam protection, and parental controls, you do get a rescue media option (USB or CD) along with a software updater that alerts you to outdated programs. This is a thoughtful inclusion, as black-hat hackers are always on the hunt for security holes to sneak malware through.



Avast recognizes the importance of keeping third-party programs up to date and will let you know which ones have an upgrade available.

Most of Avast's attempts to upsell security are confined to the Store menu, which is where you'll find add-ons and upgrades available for purchase. We like this tactful approach, as well as Avast in general.

VERDICT 8

Avast Free Antivirus

Free, http://www.avast.com

AV FEATURES

	Bitdefender	Kaspersky	Norton	Panda	McAfee	Webroot	ESET	AVG	Avira	Avast
Email scanning	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
IM scanning	Y	Y	Y	N	Y	Y	Y	N	N	N
Virtual Keyboard	N	Y	N	Y	N	N	N	N	N	N
Facebook scanning	Y	N	Y	N	N	N	Y	Y	Y	N
Heuristics	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Firewall	Y	N	Y	Y	Y	Y	Y	N	N	N
Spam controls	Y	Y	Y	Y	Y	N	Y	N	N	N
Parental Controls	Y	Y	Y	Y	Y	N	Y	N	N	N
File Shredder	Y	N	N	N	Y	N	N	N	N	N

AV PERFORMANCE

	BitDefender	Kaspersky	Norton	Panda	McAfee	Webroot	ESET	AVG	Avira	Avast
Scan 1 (min:sec)	3:42	9:00	6:40	13:55	9:45	0:42	3:48	4:33	7:53	6:20
Scan 2 (min:sec)	0:46	1:01	2:15	12:30	6:40	0:15	0:26	0:38	7:48	5:09
PCMark 8	3,444	3,427	3,446	3,442	3,422	3,439	3,447	3,437	3,426	3443
Peacekeeper	2,199	2,199	2,206	2,171	2,218	2,162	2,214	2,209	2,210	2,210
Boot (seconds added)	+3	+2	+0	+3	+2	+3	+1.5	+2	+1	+2
3GB File Transfer (seconds added)	+0	+0	+0	+3	+0	+0	+1	+1	+1	+1

Our test machine has an Intel 2.8GHz Core i7-930, Asus P6X58D Premium, 4GB Corsair DDR3/1333, Radeon HD 5850, 120GB Kingston SSDNow V300 (OS), Western Digital Red 3TB 7,200rpm (storage), and Windows 8.1 Enterprise.

Let's face it, laptops can be really expensive, especially the high-end gaming notebooks we recommend. They can also be heavy and a chore to carry around. And yet, to get your money's worth out of these portable PCs, you'll have to lug them around with you all the time.

But finding the right bag—one that protects your computer while being comfortable to wear—is no easy feat. And it's not too much to ask that it be somewhat visually appealing, if not downright attractive. You've spent your hard-earned money buying a kick-ass laptop and you deserve an equally kick-ass backpack to put it in. So, to help you with your baggage, we searched for the best laptop backpacks that we could find and rounded up seven worthy contenders.

BY JIMMY THANG

WE'VE GOT

WE HUNT FOR THE BEST LAPTOP BACKPACK

YOUR BACK

MAXIMUM PC AT ITS BEST
ANYTIME, ANYWHERE!

HELLO, 4K LCD!
Asus 31.5-inch panel boasts four times the resolution of 1080p PG. 76
AC ROUTERS ARRIVE
Seven 802.11ac Wi-Fi routers demo the new spec's capabilities PG. 34
ASROCK M8
Build your own micro-tower with this BMW-designed bare-bones kit PG. 74
MAXIMUM PC
MINIMUM BS • FEBRUARY 2014 • www.maximumpc.com
SUPERCHA
YOUR PC
MOVE YOUR OS TO AN SSD AND REAP AMAZING REWARDS—WE SHOW YOU HOW!
PG. 22
BUILD IT:
AMD's R9 290X in a small form factor PC! PG. 58
Future
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MAXIMUM PC
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PG. 22
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EVERKI BEACON

LARGE BUT IN CHARGE

The dashes of orange give the black bag a nice "pop."

TRYING TO find an AAA-quality backpack that can also fit a large 17-inch gaming notebook can be like looking for a needle in a haystack, but Everki's Beacon is up for the challenge. Its laptop compartment had no problem fitting our monstrous 17-inch Asus ROG G750.

This backpack is quite roomy, measuring 20.8x16.9x6.3 inches, and it's a little on the heavy side at 3.5 pounds, making it more of a travel pack than something you would carry around every day. But because of this bulk, the Beacon offers a lot of protection with its mesh padding, while providing plenty of compartment space, too.

In addition to the laptop slot, there's an even roomier main compartment, which has a zipper for folders, four 3x5-inch pockets, and even a soft-shell bag inside designed to house consoles. In short, there's plenty of space for whatever you need. Outside of the main compartment is a 3x11-inch easy-access pouch, which is optimal for sunglasses. It also has two small hip compartments on either side of the bag; the left one has a little hole for ear buds, and you can loop the cord through the left strap to get a tangle-free listening experience.

The build quality is impressive, including plenty of rubber padding at the bottom of the bag in case you accidentally drop the pack. The Beacon also comes with a water-resistant tarp that you can use to wrap the bag in case of rain.

While the Beacon isn't light, its pillow-soft straps are extremely comfortable, and it features a stretchy chest strap that takes the pressure off your shoulders. In addition, it has two sturdy handles: one on top of the backpack and another on the back. Considering you can get all of this for $100, it's one hell of a deal.

VERDICT **9** KICK ASS!

Everki Beacon

$100, www.everki.com

FUL DEAN

THE BUDGET BACKPACK

The Dean gets the job done, but is mostly no-frills.

WHILE EXPENSIVE backpacks are often nice, we realize that not everyone can afford them, especially if you've spent all your dough on a sweet gaming laptop. However, this doesn't mean you have to resort to tossing your super-nice notebook in your kid's old cheapo Jansport, which offers little-to-no protection for your gear.

If you don't have a large notebook, don't need a ton of bells and whistles, and if you're on a budget, Ful's $70 Dean backpack may be what you're looking for.

While Ful says the Dean can fit some 17-inch notebooks, it's really geared more toward 15-inch and smaller machines. The laptop compartment comfortably fit our fat 14-inch Alienware 14 notebook, but while there's plenty of padding on the back, we would have liked a little more at the base of the pack, in case you set it down too abruptly. Its main compartment is quite basic, simply offering a 6x8-inch mesh zipper to stow pens and small notepads. On the face of the pack are three smaller, triangular-shaped pockets that zigzag across each other. These diagonal lines and zippers were meant to create an interesting aesthetic, but they look odd and aren't terribly practical—how many items do you know have (or want) that are triangularly shaped? The pack also has hip compartments on both sides, with one designed for a water bottle. The only other pocket is the 2x4-inch zipper on the right shoulder strap that is ideal for something small, like car keys.

Speaking of straps, there's a chest harness attached, which is greatly appreciated, but the straps in general tended to be a little wider than we would have preferred, and tended to flare out at the sides. We did like the handle atop the pack, however, which feels quite sturdy.

Overall, the pack isn't bad, but for a few dollars more, we recommend going with the SwissGear bag in this roundup.

VERDICT **7**

Ful Dean

$70, www.ful.com

SWISSGEAR SA1908 SCANSMART

THE SIMPLE PACK

There are bottle pockets on either side of the pack.

LONG KNOWN for its Swiss army knives, SwissGear has recently been making waves in the backpack scene. But unlike the tool that seems to have everything, the SwissGear SA1908 ScanSmart backpack opts for simplicity. There are no fancy hip harnesses, nor are there a million pockets.

One interesting quirk it does have, as its clunky name might suggest, is a "ScanSmart" pocket. This means its laptop compartment has a see-through mesh window, which is supposed to expedite TSA bag checks. From our experience, however, the TSA always wants laptops removed from their bags anyway, so your airport mileage may vary. If that feature doesn't quite cut it, however, there is another zipper above the ScanSmart pocket that splits completely open like a flat clamshell. This clamshell compartment should be able to fit most 17-inch laptops; unfortunately, it was not able to swallow our beefy Asus ROG G750.

The main compartment has a dangling pouch for your phone, and it also has a convenient small hole for your ear buds to slip through. This pouch fit our relatively large 5-inch Nexus 5, so it should be able to fit the majority of phones out there. Rounding out the compartments is a small, plain 7.5x10-inch zip. Another neat, if minor, feature is the little loop on the left strap that you can use to carry your sunglasses.

In terms of padding, there's not an exorbitant amount, but it should protect your laptop in most cases. There is a fair amount on the back, however, and it is quite comfortable to wear. There's even some space between the back padding along the spine, which gives your back a little room to breathe.

VERDICT **8**

SwissGear SA1908 ScanSmart

$73, www.wengerna.com

ASUS ROG NOMAD

BUILT FOR GAMERS

There's no Asus branding on the pack itself.

IN CONJUNCTION with its massive 17-inch ROG gaming notebooks, Asus has designed the ROG Nomad backpack to be "built for gamers," or so they claim. While that might sound like marketing hyperbole, the pack lives up to the claim.

Everything about the Nomad has been meticulously designed for portable-PC enthusiasts. Its large 20x13.7x7.2-inch size will fit pretty much any 17-inch gaming notebook you throw at it, but what really gears it toward laptop enthusiasts is the dizzying array of specialized compartments. There's the large main compartment that has designated spots for headphones, camera, keyboard, and power brick. The slightly smaller pocket above the main compartment contains a slit for 3x5-inch index cards, slots for pens to slip into, and there's even a little HDD carrying case can be taken out. It really has all the trappings that a nerd would need from a backpack. Hell, there's even a smartphone zipper built into the right shoulder strap, though it won't fit any phone larger than 4 inches.

The shoulder straps are also quite comfortable. And they're aided by not only a chest strap, but a waist strap to distribute weight across your entire torso, adding stability to the comfort. In addition, it offers plenty of protection for your gear as well, with plenty of rubber padding at the base of the backpack in case you drop it. And the entire thing is made out of ballistic nylon, chosen for its water-resistant protection.

Aesthetically, the pack definitely tries to entice gamers. There's a "gladiator helmet" design on the pack, which is supposed to look cool, but it's a little too garish for us. Another gripe we had is that one of the buttons fell off, although it's merely an aesthetic blemish. Regardless, this is still one hell of a pack.

VERDICT **9** KICK ASS!

Asus ROG Nomad

$170, www.lenovo.com

TIMBUK2 UPTOWN

THE HIPSTER BAG

The Uptown's biggest drawback is that it lacks padding.

LET'S FACE IT, most gaming laptop backpacks are nerdy-looking. But while there's absolutely nothing wrong with that, if you want to lug your laptop in something more trendy, the Timbuk2's Uptown Laptop bag's contrasting grey meshes will make sure you fit in with the hipster crowd (skinny jeans not included).

In terms of features, it has the bare essentials. While the pack looks fairly small compared to the others featured here, it actually measures 19.7x11.8x8.7 inches. And while its clamshell laptop compartment, which splits completely open for situations like TSA bag checks, doesn't fit giant notebooks, its large main compartment fit our massive 17-inch Asus ROG gaming laptop—much to our surprise.

Timbuk2's simple design inluces a smaller secondary compartment with two 3x5-inch index card mesh zips and a relatively small 5x10-inch velcro pocket. Above the main compartment is a smaller 13x8-inch zipper, which has pockets for pens and other small items. Above that is a vertical quick-access slit where you can store small notepads. Other than the bottle holder on the left hip, there really isn't too much else to this bag, aside from a bottle opener on the right strap, which you and your friends will appreciate when it's called for.

In terms of comfort, there isn't an exorbitant amount of padding, but it still feels good, partially thanks to a chest strap, which we liked. We would have preferred more padding for the laptop compartment, however, as the Uptown is one of the least protective packs here. Another gripe that we had is that its top handle is not comfortable or easy to use; it's just flat nylon webbing.

VERDICT **8**

Timbuk2 Uptown Laptop TSA-Friendly Backpack

$119, www.timbuk2.com

URBAN XPLORER

THE EUROPEAN

You can take off the shoulder straps to turn it into a messenger bag.

EVEN THOUGH Urban Xplorer's HalfPack RT was actually designed in California, we still call it the "European backpack" around the office. There's just something about the odd belt loops, bright burnt-orange (it also comes in black) day-pack-like body, and weird, detachable U-shaped shoulder straps that screams "This is what you carry to go yodeling in the Alps." It's clearly trying to cater to the "sophisticated businessman who also has an adventurous side," but there's just something awkward about it.

While the pack certainly isn't for everyone, it does have its nice qualities. There's plenty of cotton/polyester padding everywhere, and bag is covered with a nylon ballistic fabric that is designed to be weatherproof and stain resistant. Another perk is that it has a sweet, sexy brown leather handle.

Even though the pack features two belt-style bands to keep it closed, they're more a novelty, as the flap of the pack can also be opened via two quick-release buckles. When you lift the flap, you'll find two index card–sized velcro pockets, and a larger 9x12-inch zipper compartment designed to hold pens, glasses, and other stationery.

Arguably, the HalfPack RT's biggest problem is that despite it being the heaviest pack in the roundup at whopping 4.5 pounds, it's not very spacious—its main compartment was barely able to house our 14-inch alienware notebook. The pack's actual laptop compartment could barely fit our svelte 13.3-inch Acer S7 Ultrabook. Also, accessing the main compartment is cumbersome, even with the quick-release buckles, because you have to lift its flap vertically to reach your arm into the bag. When you add in the fact that it's $200, the Urban Xplorer is simply a tough sell.

VERDICT **6**

Urban Xplorer HalfPack RT

$200, www.xplorerbrand.com

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OGIO RENEGADE

THE MACHO BAG

The Renegade is rugged and has tons of pockets.

IF WE HAD to crown the manliest bag in this roundup, it would have to go to Ogio's Renegade RSS 17. Hell, even the name "Renegade" implies that it's pretty badass, and thankfully, it lives up to its moniker.

The Renegade isn't the biggest pack in the roundup but it's still pretty large, measuring 19.5x14x8 inches. It's quite rugged and offers plenty of protection with its rigid frame and copious amount of padding. There's also a nice padded soft-touch neoprene grab handle at the top, and its 600D polyester material feels high quality across the board. It's very comfy, to boot, and has a chest strap in case you need to lug around heavy gear.

Unfortunately, this backpack won't be able to carry the heaviest of laptops—even though it's advertised to fit 17-inch notebooks, it couldn't fit our thin 17-inch iBuypower Battalion, let alone our beefy 17-inch Asus ROG G750. Regardless, you'll find that the bag has a ton of pockets to play around with, which include a hard-shell sunglass cubby, a spacious main compartment, a tablet compartment, and another smaller pocket with designated slots for mouse, wallet, and pens. In addition, there are two pairs of pockets on the side of the pack and a phone-sized zip behind the Ogio logo. There's also a small zipper on the left shoulder strap, though measuring 1.5x4.5 inches, it's much too small for even keys.

In terms of aesthetics, it's predominantly black with some silver and red accents, giving it a tough appearance. At $135 street, Ogio is pricing the Renegade in the premium tier, but this bag well deserves inclusion in that class.

VERDICT **9**

Ogio Renegade RSS 17

$135, www.ogio.com

CONCLUSION:

If you've combed through all the reviews here, you might have noticed that there is a positive correlation between the largeness of a pack and its score. It's not that we think that bigger is necessarily better, but the larger packs here just happened to get a little more TLC from their manufacturers. This isn't to say that the smaller bags in this roundup are worthless. Really, there's something here for every kind of laptop user: from small to large, from cheap to luxurious, they all have their strengths.

Still, if you asked us to design the ultimate laptop backpack for enthusiasts, we would definitely love to be able to combine different elements from all the packs reviewed here. The super pack would have the hip stylings of the Timbuk2 Uptown with all the specialized compartments of the Asus Rog Nomad. We would definitely want to toss in the durability of the Ogio Renegade, with, of course, the same amazing value that the Everki Beacon boasts. That would definitely be the quintessential laptop backpack. Until then, however, we're still confident that you'll find something in this roundup that packs the punch you've been looking for.

SPECIFICATIONS

	Everki Beacon	Ful Dean	SwissGear SA1908 ScanSmart	Asus ROG Nomad	Timbuk2 Uptown	Urban Xplorer HalfPack RT	Ogio Renegade RSS 17
Size H x W x D (inches)	20.8 x 16.9 x 6.3	18 x 11 x 5	18 x 13 x 9	20 x 13.7 x 7.2	19.7 x 11.8 x 8.7	17 x 13.4 x 7	19.5 x 14 x 8
Weight (pounds)	3.5	2.5	2.6	3.6	2	4.5	4
Fits 17-inch notebook	Yes	Some	Some	Yes	Yes	No	Some
Chest strap	Yes	Yes	No	Yes	Yes	No	Yes
Street price	$100	$70	$73	$170	$119	$200	$135

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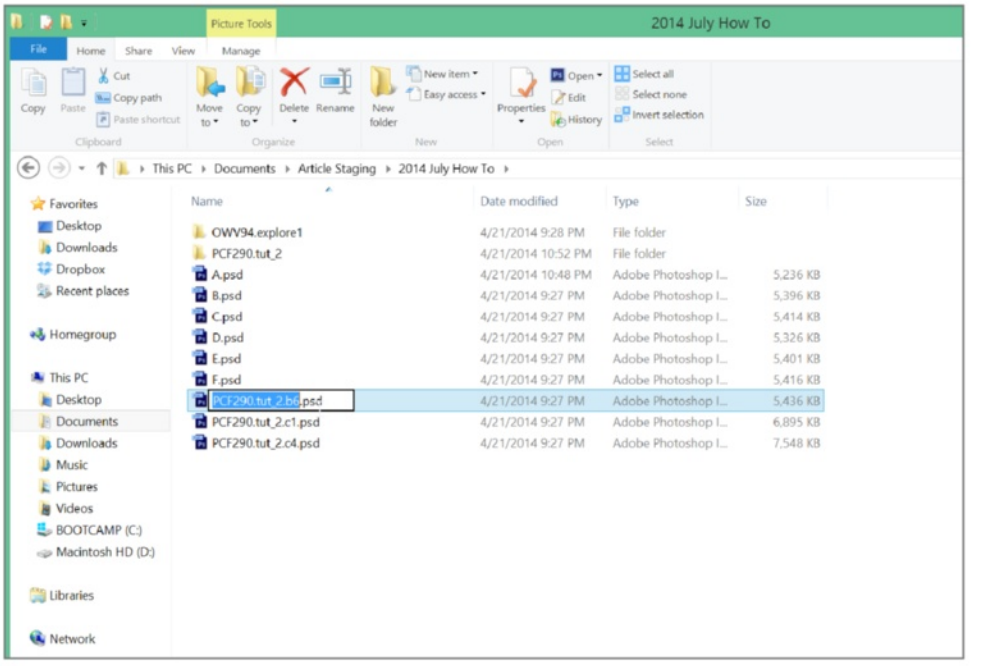
HOW TO

STEP-BY-STEP GUIDES TO IMPROVING YOUR PC

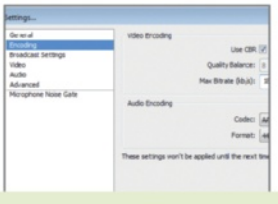
WINDOWS TIP OF THE MONTH

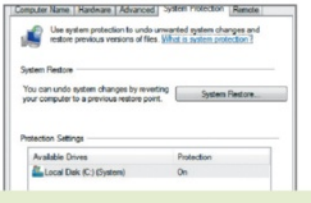


RENAME FILES IN A HURRY

Need to rename a bunch of files, but don't want to have to click each one twice? Use these two shortcuts to speed up your file rename: 1) With any file selected, press F2 to automatically enter renaming mode. 2) While renaming a file, press tab to start renaming the next file in the list.

MAKE - USE - CREATE





66 Become a Twitch TV star

68 Restore files with Previous Version

ALEX CASTLE
CONTRIBUTING EDITOR

LOST YOUR WINDOWS INSTALL MEDIA?

IF YOU'VE LOST your Windows install DVD, but still have your product key, it can feel like there's no good way to reinstall. Microsoft doesn't advertise a way to download an installation ISO, and the alternative—wading into Torrent sites—is always an unpleasant experience. Fortunately, whether you're using Windows 7 or 8, there's a legal way for you to download Windows installation media.

If you have a Windows 7 product key, you can download a Windows ISO from Techriver. I've never been fully certain why this is the case, but Techriver has hosted up-to-date ISOs for Windows 7 for years, with Microsoft's blessing. There's no landing page for the downloads, but you can find URLs for the various different versions by doing a Google search for "Techriver Windows 7."

If you have a Windows 8 or 8.1 product key, you can download Windows directly from Microsoft at http://bit.ly/MPC_WinProdKey. Just click the link for Windows 8 or 8.1 (if you have a Windows 8 product key you'll have to download Windows 8, then update to 8.1), and you'll download an application that will check your product key and download the necessary files for you.

↘ submit your How To project idea to: comments@maximumpc.com

Become a Twitch TV Star

YOU'LL NEED THIS

A TWITCH ACCOUNT
If you want to stream on Twitch, you'll need a free user account.

OBS
Open Broadcasting Software is sophisticated, free screencasting software designed to broadcast your gameplay in a way that's polished and engaging. Get it at https://obsproject.com.

LAUNCHED A MERE two and a half years ago, Twitch has become the go-to website for anyone with even the vaguest interest in gaming.

Started by Emmett Shear and Justin Kan, who founded live-streaming platform Justin.tv, Twitch capitalizes on the growth of eSports as an actual thing people enjoy. It attracts a whopping 45 million unique viewers per month, each of whom watches 95 minutes of live video a day.

Twitch's success has risen hand-in-hand with that of League of Legends. Riot Games's free-to-play multiplayer online battle arena game is notable for being the first to utterly nail the deceptively simple genre, and its viewer numbers dwarf those of Twitch's other games, including DOTA 2, Hearthstone: Heroes of Warcraft, and Counter Strike: Global Offensive. It helps that League of Legends will run on the worst netbook in the world, which makes transcoding and streaming videos a much more manageable task.

The third piece of this addictive and lucrative online trinity is you. Yes, you there. Like YouTube, it's possible to waste hours browsing and watching videos on Twitch, but it's also possible for you to create your own channel, attract hordes of viewers, and become a millionaire. And all you have to do is sit and play games while being incredibly sarcastic. You won't even have to leave the house. –HENRY WINCHESTER

1 UNDERSTANDING TWITCH Twitch has built-in support for various streaming clients, and it'll even plug straight into DOTA 2. The best all-around solution we've found is Open Broadcaster Software (OBS), which is free, open source, and relatively painless to set up. However, after that it gets a little more complicated, and you may have to adjust a multitude of variables to get the best quality without breaking the Internet or setting fire to your computer.

» The first thing to do is to poke around on Twitch itself. You'll find live streams from gamers around the world, and lots of different games (but mostly League of Legends). There is no recipe for success on Twitch, but being good at a game really helps. Games such as League of Legends are the perfect fodder for Twitchers because they have so many intricacies, and players are always on the lookout for tips and tricks. Being able to demonstrate these while you're actually playing the game is a big part of Twitch's success.

» Personality counts for a lot, too. We'll show you how to set up a webcam so your viewers can see your reactions to the unpredictable moments in online gaming (**Image A**). Take note: being able to make a joke when you screw up something gives you a sense of personality and character. Viewers hate silence, so just keep babbling—even if you're talking utter nonsense—and you'll retain your audience. You won't even know you're being recorded with the OBS method demonstrated here—you simply have to provide an ongoing narration.

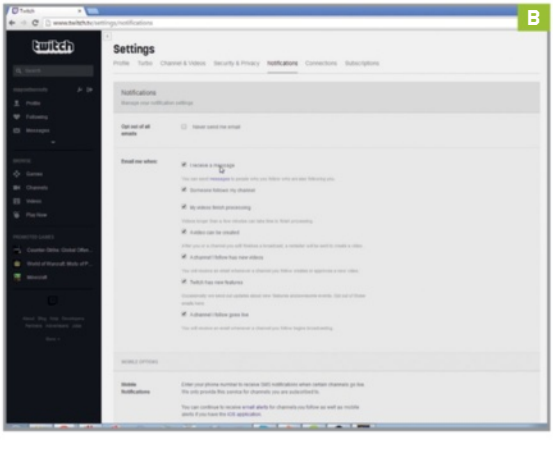
» In Twitch terms, the biggest milestone is reaching a regular viewership of over 500 people, and broadcasting content at least three times a week. At this point you can become a Twitch "Partner," and will be paid a percentage of your video revenue and even subscription fees—if you feel confident enough to lock your channel behind a paid-for gate.

» Attracting those 500 viewers may sound like a Herculean task, but it can be done, especially with the help of social media. Start a Twitter account for your Twitch username, and find fellow Twitchers to follow. A YouTube channel for your greatest moments can also drive traffic, and you can set OBS to back up streams to your PC so you can edit and upload them.

» If the idea of playing games with a live commentary doesn't appeal, you can submit gaming videos to Twitch in a pre-recorded, YouTube-style format. One of the biggest shifts in Internet tech recently has been the drop in the price of online storage and bandwidth. This means Twitch is able to keep content flowing, like a bizarre live news channel where all the stories involve magic spells and slaughter.

» Once you've created a Twitch account, you'll find various options to customize and set it up. In the Channel and Videos menu, you can add a banner—formatted to 16:9—to welcome people to your channel. You can also add a background image; we'd recommend using light or pastel shades for this, otherwise you risk giving your viewers migraines.

» The Dashboard is where you alter Twitch's broadcast settings (**Image B**). Here, you'll find a preview of your channel, and you can set your current broadcast's title and the game you're playing. In addition, there's an archive of all your previous broadcasts, as well as stats so you can see when you're attracting the most viewers. The Stream Key is vital—this is used to identify your channel to other programs and apps, such as Open Broadcast Software. It's a good idea to email this to yourself so it's always handy.



2 SET UP OPEN BROADCASTING SOFTWARE To get started with your streaming career, download Open Broadcasting Software from https://obsproject.com, then fire it up and click the big Settings button. Add a profile name, then go to the Encoding tab. Make sure "Use CBR" is checked. Max bit rate can vary between 500 and 3,500Kb/s. Remember that while larger numbers will result in a better-quality stream, they may impact your computer and network performance. Set this to 1,800Kb/s to start with (**Image C**).

» Next, go to Broadcast Settings. Under "Mode," make sure "Live Stream" is selected, and "Twitch/Justin.tv" is set as your streaming service. Choose your closest geographical server (**Image D**) and paste your Twitch stream key into the relevant box to link OBS to Twitch. Choose "Save to file" and select a file path for your recordings. Saved files will be large, so make sure you've got plenty of room on your hard drive.

» Stream hotkeys allow you to start a Twitch stream in-game, so set these to rarely used key combinations—we use Ctrl + F7 and Ctrl + F8 (**Image E**). Under the Video menu you'll find the option to downscale your stream, which can free up bandwidth and resources. Upping the FPS and lowering the resolution here can result in better-looking streams on certain games, including League of Legends.

» The Audio menu is fairly self-explanatory. We've found that specifying audio devices rather than choosing Default solves a few problems (**Image F**). Choose hotkeys for "Push-to-talk" if you don't want your mic on all the time. The Microphone Noise Gate menu can mitigate the need for push-to-talk by only switching the input on when your voice goes above a certain volume; play around with it until it works.

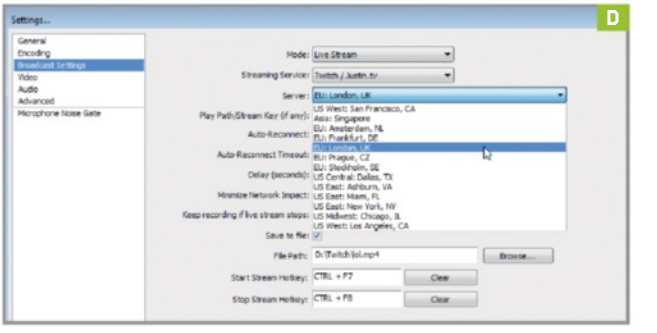
» In the Advanced tab, make sure that "Use Multithreaded Optimizations" is checked. Set process priority class to Normal, and choose a scene buffering time of 400ms (**Image G**). X264 CPU presets refer to the speed at which the processor compresses video—the faster it does this, the less intensive it is, so choose "Very fast" unless you've got a super PC.

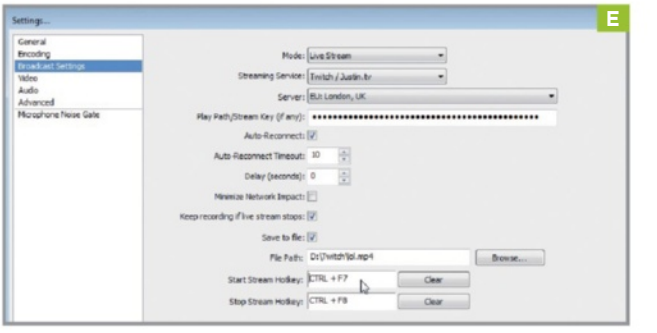
» Set Keyframe Interval to 2 and check "Use CFR." Ensure that "Bind to Interface" is set to Default, and "Latency tuning factor" is set to 20. Leave the other settings alone unless you know your custom X264 encoders from your Mic QPC timestamps. OBS will flag anything you've missed in red text, so correct these if necessary.

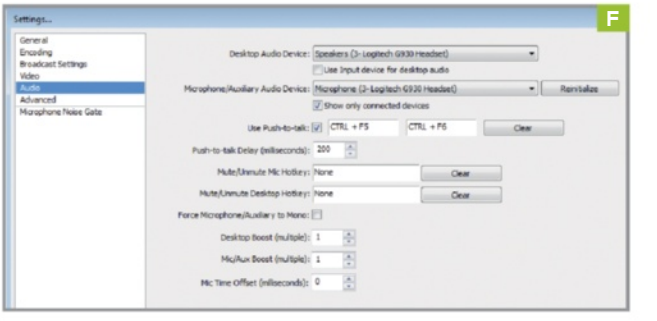
» We're almost there now. Fire up League of Legends, then put it into windowed mode (so you can see what you're doing) by pressing [Esc] and choosing Settings. Alt + Tab to OBS, right-click under Scenes, choose "Add scene," and call it "LoL." Now, right-click under Sources and select "Add game capture," then choose the League of Legends client from the drop-down menu.

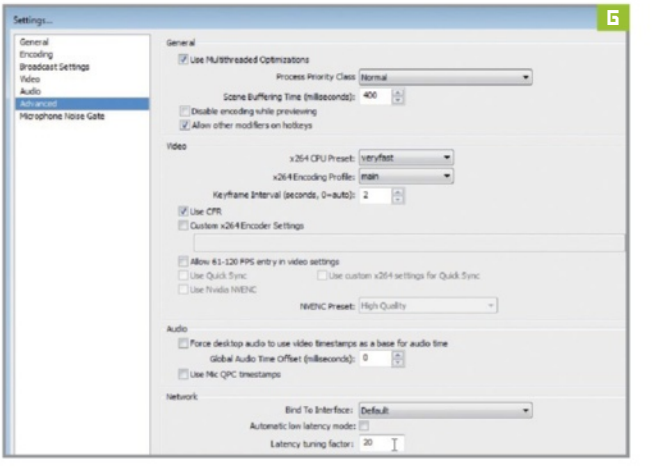
» Click "Preview stream" and you should see the League of Legends window appear within OBS, although it will only fill part of the screen. Return to League of Legends and switch it back to the maximum resolution of your monitor, then return to OBS and it should now fill the entirety of the preview window. To add your logo, right-click under Sources, and choose Add, followed by Image.

» Browse for the image file you wish to use and add it in. If you wish to specify the transparency, select "Use color key" and choose the color you wish to make transparent. You'll now see your logo on top of the game. To move it, click on "Edit Scene" and then drag it around until you find a good spot, using the red edges to resize it.









Continued on next page

3 ADD A WEBCAM AND START YOUR FIRST STREAM

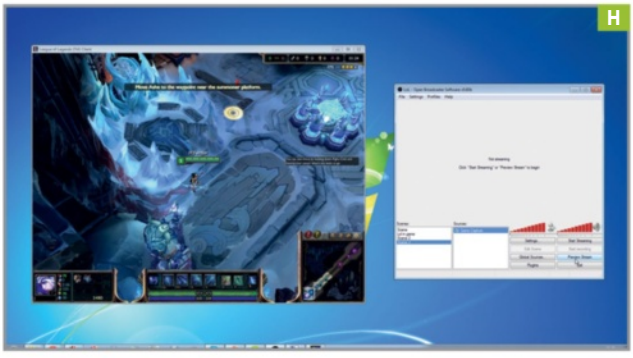
You can use the same method to add a webcam by choosing "Video Capture Device" in the menu under Sources. Resize the webcam window and place it somewhere that it won't be too much in the way. You can also right-click on elements in Sources and use the Order options (**Image H**) to place things on top of one another, which is handy if you want to place a logo over your webcam display.

» Your lovely OBS setup is ready for you to start broadcasting, but it's worth doing a test run first. Click "Start streaming," quickly followed by "Stop streaming," and OBS will save your stream to the folder you specified in the settings. Check that everything looks OK, and fiddle with OBS's layout if necessary (**Image I**).

» Now you're ready for your first stream. It's a good idea to open your Twitch dashboard on a second screen, such as a monitor or smartphone, so you can see your channel in action. Now that it's up and running, you can gently increase the bit rate and resolution to see how it affects your stream's quality.

» There are lots more settings to play with. Under Sources you can select "Image slide show," which shows a series of images, and is handy for displaying sponsorship information on a crowded MOBA screen. By using the Text option, you can show a scrolling message in any font you've got installed on your PC. This is great for bringing new information to your viewers.

» Although we've focused on League of Legends, it's easy to add games to your stream—just run them and specify the right window in the "Add game capture" source. League of Legends and DOTA 2 rule the roost for now, but Counter Strike and World of Warcraft: Mists of Pandaria are gaining viewers. We reckon having a unique take on either of those titles could stop you drowning among all the other LoL channels.Get in there and establish your channel before it's deluged with freshly arrived, loud-mouthed console gamers.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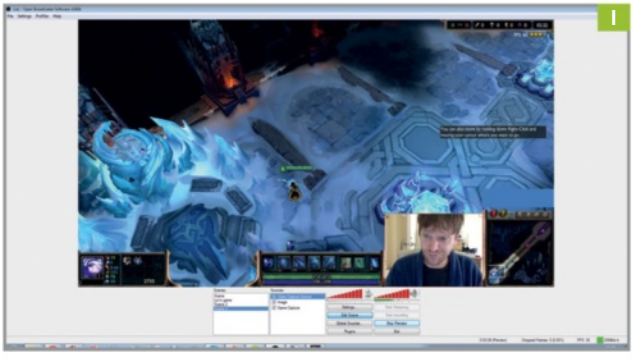

I

Restore Deleted Files with Previous Versions

YOU'LL NEED THIS

WINDOWS 7 OR LATER

The Previous Versions feature was introduced in Windows 7, and is also available in Windows 8 and 8.1.

ACCIDENTALLY deleting a particularly important file—it's something we've all done. We've certainly done it enough times in the past to recognize that feeling of instant regret. But erasing a file isn't the only thing that can go wrong with documents; it's also very easy to edit a document, save it, and then later change your mind about the editing you've done.

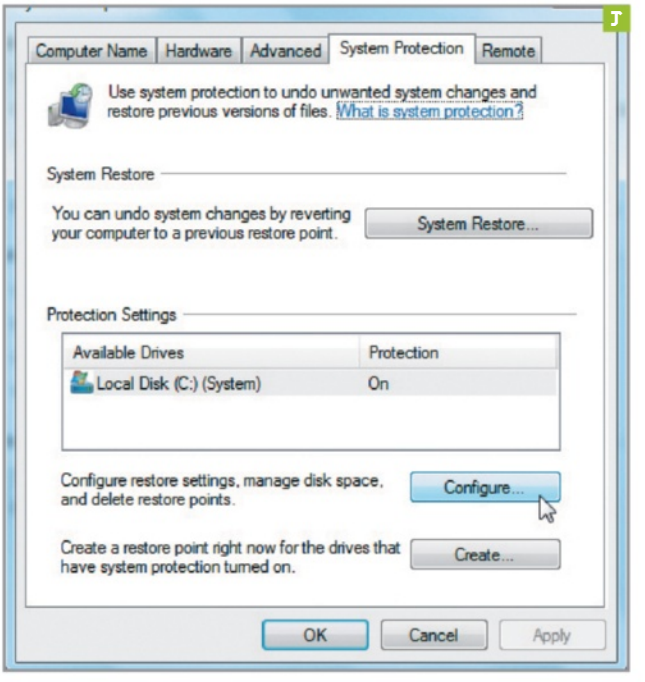
The good news is that the Previous Versions feature of Windows 7 can help to eliminate these problems by making it possible to automatically save snapshots of your hard drive, so you have the option of reverting individual files to an earlier version if necessary—or even restoring files that have been accidentally deleted. Previous Versions is surprisingly easy to get up and running, and you never know when it might come in handy in the future, so activate it as soon as possible. **–MARK WILSON**

1 ACTIVATE PREVIOUS VERSIONS To set up Previous Versions, begin by clicking Start and then selecting the Control Panel shortcut to the right. Click the System icon, followed by the "System Protection" link to the left of the window. In the Protection Settings section toward the center of the dialog, click the entry for your C drive, and then the Configure button (Image J).

» Select the option labeled "Restore system settings and previous versions of files." Use the slider that appears in the bottom portion of the dialog box to choose how much of your disk space should be set aside for previous versions of files and System Restore Points. This will depend on the size of your hard drive. Once you've finished, click the OK button.

» Windows automatically starts to create System Restore Points so you can return your PC to the way it was at an earlier date, and begins saving multiple versions of files for you. Get started by clicking the Create button on the System Properties tab. Enter a name for your first Restore Point before clicking Create. The date and time are automatically added for you.

» You may have to wait for a little while as the System Restore Point is created—it's quite a complex process that uses a lot of your PC's resources. Once it's complete, click the Close button that appears.



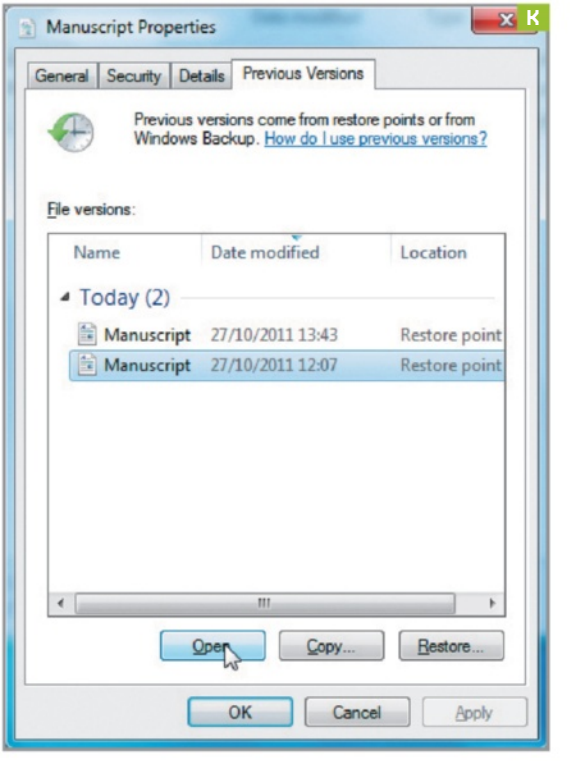
2 RESTORE A FILE If you discover that you've made and saved unwanted changes to a document, right-click it and select the "Restore previous versions" option. Alternatively, you can right-click a file and select the Properties option from the menu that appears before moving to the Previous Versions tab.

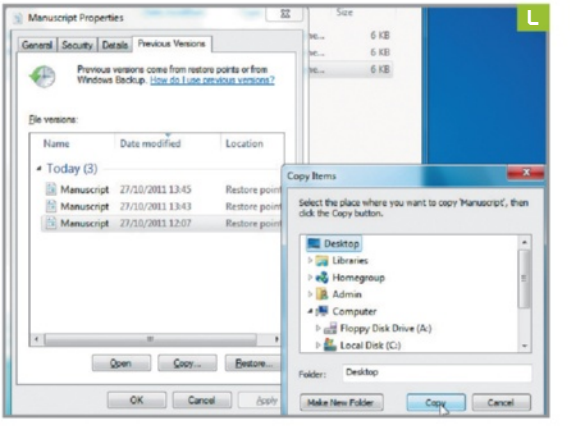
» A list of previous versions of the selected file is displayed, and you can then choose which one you would like to work with—click the Open button to check the contents of a particular document (Image K). Work through the list until you identify the file version that you would like to restore.

» Once you've decided which file you're interested in, click the Restore button. Take note of the warning message that appears, explaining that continuing will overwrite any existing file, and then click the Restore button if you're happy to continue. Once the process is complete, click OK.

» To avoid overwriting an existing file with one you're restoring—which could cause a problem if you still need some data in the file or if you accidentally restore the wrong file—it's a good idea to use the option to create a copy of the older version of the file. To do this, on the Previous Versions click the Copy button, navigate to the folder you would like to use, and click the Copy button again (Image L).

» If you realize you've deleted a file by accident, it's no longer a problem—thanks to Previous Versions, you can get it back quickly and easily. Right-click the folder it was stored in and select the "Restore previous version" option from the menu that appears. You can then double-click one of the previous versions of the folder and create a copy of the file you're trying to retrieve.





BUILD IT

CHRIS ZELE **CONTRIBUTING EDITOR**

Putting Together a Home Theater PC

We build a Thin Mini-ITX machine, which is not only small but fast, stackable, and packed with tons of storage

LENGTH OF TIME: **1–2 HOURS** | LEVEL OF DIFFICULTY: **MEDIUM**

THE MISSION Today's HTPCs tend to be either diminutive NUC-style bricks, or big desktop cases bristling with hard drives and GPUs. For this month's build, we decided to see if we could create something that offers decent performance and storage options while never screaming to the world that you have an HTPC tucked in your AV rack.

In other words, we wanted to build a PC that at first glance would look like a Blu-ray or DVD player. For that, we turned to Silverstone's austere PT12B and reached for the motherboard form factor no one ever thinks of: Thin Mini-ITX. Thin Mini-ITX is an extension of the Mini-ITX pushed by Intel. This board is primarily intended for use with DIY all-in-one PCs, and its claim to fame is being, well, thinner.

No mobile CPU would be enough for our thin HTPC, so we reached for a desktop Haswell. Since the machine would be thin and stackable, we opted to include a slot-fed optical drive to class it up, too.

CRAMMING IN THE HARDWARE

WE STUFFED ALL of our hardware into a Silverstone PT12B Thin-ITX chassis. Oddly, this case doesn't have cutouts for mounting wireless antennas, so we used a Netgear N600 USB adapter for our PC's wireless duties. It's not optimal, as we burn an external USB port, but the alternative would have been to put patch antennas inside an all-metal chassis, which we found even less ideal.

We outfitted our case with a Gigabyte H87-TN motherboard, which comes with one mSATA port, four SATA 6Gb/s ports, a x4 PCI Express slot, and two SO-DIMM slots. Next, we threw in a Core i3-4330. This dual-core Haswell part has Hyper-Threading, buzzes along at 3.5GHz, and has a TDP of 54 watts. Cooling this power-sipper is Silverstone's low-profile AR04 cooler, which fits perfectly into the 1.4-inch tall case.

Now for the important stuff: the storage. We knew we wanted a fat drive for local storage duties, but we didn't want to compromise on responsiveness, so we put in a Crucial M500 128GB mSATA SSD for $75, which gives us a fast boot disk with ample storage for our applications and OS. We then put in a mechanical hard drive for storing all of our movie media. We chose a 2TB Seagate/Samsung Spinpoint M9T drive, which claims the crown of thinnest 2TB drive available.

To power all this equipment, we used a 150W AC adapter. These adapters are sometimes used in gaming notebooks, and they're compatible with Thin-ITX mobos. Our rig only pulls about 80W, so this is more than enough power. Last but not least, we also tossed in a slimline slot-fed optical drive, so we could play our ancient DVDs on it.

INGREDIENTS

	PART	PRICE
Case	Silverstone PT12B	$90
PSU	Dell 150-watt power brick	$47
Mobo	Gigabyte H87-TN	$133
CPU	Intel Core i3-4330	$140
Cooler	Silverstone AR04	$33
GPU	Intel HD 4600	N/A
RAM	2x4GB Corsair Value Select 1600MHz	$73
Wireless Adapter	Netgear N600 USB Adapter	$45
SSD	Crucial M500 120GB mSATA	$75
HDD	2.5 inch Seagate 2TB	$129
Optical drive	Panasonic UJ8C5	$53
Cable Kit	2x Silverstone Tek Ultra Thin SATA Cables	$20
Case Fan	None	$0
OS	Windows 8.1 64-bit OEM	$120
Total		$958

1 MOUNT THE MOTHERBOARD AND INSTALL THE CPU

LAYING DOWN this Thin-ITX board is similar to installing any other motherboard, but it only takes four screws to hold it in place. Once it's secure inside the chassis, put in your processor, making sure the pins line up correctly with the socket. At the top of the processor there will be two notches cut out of the CPU's die to help you line up the CPU with the socket. Place the processor down and clamp it in place with the latch. For our processing needs, we went with the Core i3-4330, primarily because its TDP is 54 watts and our cooler only supports CPUs up to 60 watts. The 4330 gives us access to Intel's efficient cores, which are top dog today.

2 INSTALL THE COOLER

INSTALLING OUR cooler was similar to installing an Intel stock unit, but it features a much smaller Z-height than Intel's reference cooler designs. The AR04 has integrated heat pipes and can cool CPUs with up to 60-watt TDP—but it can be a tad loud.

To install the heatsink, first put a dollop of thermal paste (about the size of a kernel of corn) onto the processor, then spread the paste around so the heatspreader is evenly covered. Once the paste is applied, attach the AR04 and push the heatsink's push pins down until they lock into place with an audible click. After the heatsink is secured to the motherboard, plug the unit's 4-pin power connector into the CPU fan header. To ensure that the cooler is properly attached, check to see that all push pins are firmly attached to the motherboard. If you're unsure, you can remove the motherboard and check its underside to see if the pins are properly fastened into place.

3 DROP IN THE RAM

OUR MOTHERBOARD includes two SO-DIMM slots, so we snagged 8GB of DDR3/1600 Corsair Value Select RAM and tossed it in. We chose 1,600MHz modules because Thin-ITX boards are sometimes finicky with higher-clocked modules. DDR3/1866 and DDR3/2133 SO-DIMMs also come with voltage that's too high for non-enthusiast boards. If you're asking, "Why on 8GB?" no application we'll be using should even come close to using that much RAM. Yes, 4GB of RAM would have sufficed in a pinch, but it was only $35 more to move up to 8GB, so why not? Installation of the memory is similar to that of a laptop; it requires you to push the DIMMs in at angle, then slowly apply pressure until you hear them click into place.

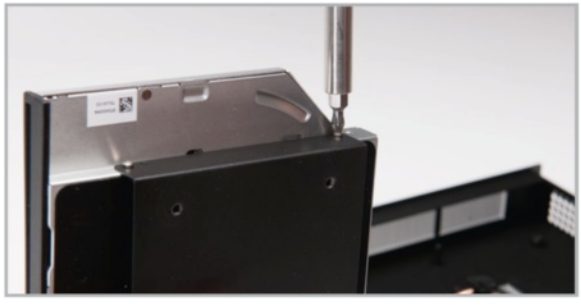
4 INSTALL THE MSATA DRIVE

THE 120GB CRUCIAL M500 mSATA drive we chose for this rig was $75, meaning we paid roughly 62 cents for each Solid State gigabyte—a bargain-hunter's dream! In the past, mSATA drives were very expensive at around $2 per gigabyte. We're glad to see this has changed and more affordable solid-state storage is finally coming into the marketplace. Installing an mSATA may seem scary, but it's just like installing a SO-DIMM with an added catch: You'll need to screw it into place. Put the mSATA SSD into the mSATA slot at a low angle and press down on it slowly until it touches the screw mount on the motherboard, then screw it into place. Depending on your motherboard, you'll use either one or two screws to attach it.

5 INSTALL THE ODD

PUTTING IN THE ODD was quick and easy. We unscrewed the case's ODD cage and dropped our DVD drive into it. You'll need a small Phillips screwdriver for the miniature screws that hold the optical drive in place. Silverstone's PT12B case, fortunately, comes with three of these screws, so if you have a spare slimline ODD with missing screws, this case has you covered. If you're prone to losing screws, as we are, you can use a piece of tape to hold these puny screws in place while you work on your rig, and keep them from rolling away into oblivion.

When we last reviewed Cyberlink's PowerDVD 13 Ultra media software (July 2013), we praised its ability to up-convert DVDs to look better than some Blu-ray movies. The software's sharpening tool makes each image crisper and more vibrant. Unfortunately, VLC media player's sharpening tool doesn't come close to that of PowerDVD 13, which means you'll have to fork over $100 to Cyberlink to get the best HD up-conversion experience. If you pony up for a Blu-ray drive, PowerDVD will sharpen those movies, too.



6 BRING ON THE STORAGE

FOR OUR 2.5-INCH drive bay, we chose to go with a 2TB Seagate/Samsung Spinpoint M9T HDD. The Crucial M500 mSATA SSD in this rig provides us with zippy boot times (less than 10 seconds), but this mechanical hard drive gives us tons of room for storing our media. This is a media player PC, so we didn't want to skimp on the storage. To install the 2.5-inch drive, first, unscrew the hard-drive cage from the inside of the case and remove it. Next, secure the drive to the cage using normal-sized HDD screws. To finish up the installation, secure the cage back into the case, then connect the drive to a SATA cable and SATA power cable.

This chassis has another cage on its underside, allowing you to attach the PT12B to a TV or PC monitor. You'll want to have a substantial panel to attach this case to, as the full build weighs in at around 15 pounds. We would not recommend trying to attach it to a 22-inch panel; you'll likely destroy it in the process.

1. Our small mSATA SSD from Crucial is fast and takes up almost no space, with no need for SATA power connectors.

2. Thin-ITX motherboards run off external power supplies, so cable management is much easier—no 8- or 20-pin motherboard power connectors.

3. When installed, the AR04 cooler stands just one inch thick, making it a great fit for most tiny cases.

4. We wish the PT12B used this space for 2.5-inch drives instead of the optional Intel heat-pipe kit.

MORE THAN JUST A MEDIA PLAYER

TO SEE HOW WELL our thin HTPC performed, we threw it a slew of typical HTPC tasks: We downloaded a Steam game, watched DVDs upscaled to 1080P, and browsed the web. All this ran without the performance slowdowns that we remember so well from the cold, hard days of Atom-based HTPCs. We even did some very light-duty gaming, and it was surprisingly workable. We should note that "light-duty" is the operative term here. If you're expecting real gaming in the living room, you'll need a real GPU and probably at least a micro-tower form factor.

For comparison, we stacked our thin HTPC machine against the spate of NUC/Brix machines we've seen recently. We were surprised that the Core i3-4330 didn't perform as poorly as we expected against the Core i5-based NUCs, but to be fair, most of the NUC-style boxes we've tested pack dual-core mobile CPUs, not desktop quad-core parts. In our benchmarks, the thin HTPC basically body-slammed all of the NUCs we've ever tested, except one.

That one exception is the kick-ass Gigabyte Brix Pro with its Core i7-4700R quad-core chip. The Brix Pro puts the little Core i3 in its place in every test except the Google Octane 2.0 benchmark, which doesn't exactly push all the metal in the Core i7-4700R, anyway.

We should mention there was a weird anomaly we encountered with our thin HTPC machine: the CPU had issues throttling down. Apparently, Gigabyte hasn't updated its UEFI to support the newer Core i3-4330 CPU yet.

The CPU never throttling down from 3.5GHz was both good and bad for our build. The good: We got every bit of performance possible out of the Core i3-4330's 3.5GHz cores. The bad: Our cooler fan ran at a near constant 3,500rpm, making it louder than we had hoped. We hadn't exactly wanted a blaring fan while trying to relax watching movies.

Despite the AR04's fan buzzing away at ridiculously high RPMs, our Silverstone PT12B was still a very relatively cool-running case. When we put our hand on the unit, we couldn't find a warm spot anywhere on its chassis. The case stayed cool even when we were gaming. Most compact designs tend to get mighty warm under heavy loads.

Using our hindsight meter, we decided that if we had to do it again, we'd probably go with an even slower and cheaper LGA1150 chip, such as a Celeron G1820 (just $50). We could also have dropped it down to 4GB of RAM, stripped out the 2TB hard drive, and the ODD, too. At that point, though, we probably could have just bought a cheap Celeron NUC, so maybe we should be happy with what we built.

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REVIEWS

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With three 92mm fans on a 12-inch board, and an aerodynamic black-and-blue shroud, the 290 Vapor-X looks ready for vertical takeoff and landing.

Sapphire R9 290 Vapor-X OC

Sometimes size does matter

IN THE WORLD of video cards, vendors usually distinguish themselves by designing a custom fan and heatsink. These can provide better cooling and lower noise than the "reference" stock model. At the far end of this spectrum are setups like Sapphire's "Vapor-X." As the name suggests, these cards integrate a vapor chamber into the copper block that sits on top of the GPU core. Here, the block is actually hollowed out at the factory, filled with water, and sealed in a vacuum. This vacuum lowers the boiling temperature of the water, allowing it to quickly vaporize and transfer collected heat away from the GPU. Then the vapor condenses into water droplets and returns to its original position.

Cooling this fancy heatsink is Sapphire's "Tri-X" set of three 92mm fans. When the video card is idle, Intelligent Fan Control (IFC) kicks in and leaves only the central fan running. On the card itself, we also get upgraded voltage regulators and premium capacitors that can handle high loads (for overclocking).

This high-grade stuff will require more of your PC, though. Although the Vapor-X uses two PCI slots like most gaming cards, the vapor chamber's added bulk pushes the card across the third slot on your motherboard—where a second video card is frequently positioned for Crossfire. If your motherboard's PCI Express slots aren't spaced far enough apart to compensate, then you're out of luck.

The 290 Vapor-X also needs two 8-pin PCIe power cables, while the stock R9 290 and 290X cards use one 8-pin and one 6-pin. Neither AMD nor Sapphire will state a TDP (Thermal Design Power, a rough approximation of power consumption) for the 290 or 290X, but the system requirements listed on the side of the 290 Vapor-X box dictate a 750-watt power supply. You might be able to get away with less, but without official numbers, there's a large gray area. We've seen a 450-watt SFX power supply handle an Intel Core i7-3770K and a GeForce GTX 780 Ti (April 2014 issue, page 64), so it appears that Nvidia has the edge on power consumption.

This 290 Vapor-X is an excellent performer, though. While the stock version goes steadily up to 94 Celsius and begins to throttle its core clock speed of 947MHz if pushed hard enough, this Sapphire model never cracked 75C and stayed pegged at its out-of-the-box setting of 1,030MHz. Its memory also runs 100MHz higher than stock, at 1,400MHz. Judging by our benchmarks, the 290 Vapor-X runs nearly as well as a card equipped with AMD's beefier 290X GPU. That's almost as good as getting Intel Core i7 performance from a Core i5.

To top it off, the 290 Vapor-X didn't get noticeably loud. We had to stand next to the case with the side panel off to detect a mild drone. It's about on par with Asus's previous triple-slot GTX 680 cards, making it the quietest high-end AMD card that we've seen in some time, and a welcome upgrade from the stock R9 290.

Unfortunately, this near-silence comes at a premium. At press time, there were customized 290s from other vendors that cost $100 less after rebates, genuinely fit within two mobo slots, and didn't have unusual power requirements. Those cards don't push the clocks as hard, either. Sapphire's own very similar "Tri-X OC" card was $450 out the door. So at $500, the 290 Vapor-X OC is not an easy recommendation, despite its low noise and high performance. But it does hit a niche that the other cards don't, and you're getting nearly 290X performance for less than the price of a 290X.

–TOM MCNAMARA

BENCHMARKS

	Sapphire R9 290 Vapor-X OC	AMD Radeon R9 290X Reference	Gigabyte Radeon R9 290X	Gigabyte GTX 780 GHz Edition	GTX 780 Ti
Driver	14.4 beta 1	13.11 beta 9	13.12	331.80	337.50
3DMark Fire Strike	9,602	9,737	9,837	9,695	**9,976**
Unigine Heaven 4.0 (fps)	33	33	34	**39**	39
Unigine Valley 1.0 (fps)	39	36	41	**48**	**48**
Call of Duty: Ghosts (fps)	46	47	48	**53**	52
Crysis 3 (fps)	29	28	**31**	30	30
Tomb Raider (fps)	25	**27**	26	25	26
Metro: Last Light (fps)	29	17	30	25	**32**
Battlefield 4 (fps)	46	45	47	45	**52**
Batman: Arkham Origins (fps)	72	51	65	51	**78**
Assassin's Creed IV: Black Flag (fps)	28	**30**	**30**	**30**	**30**
Price (street)	$500	discontinued	$550	$520	$700

Best scores are bolded. Our test bed is a 3.33GHz Core i7-3960X Extreme Edition in an Asus Rampage IV Extreme motherboard with 16GB of DDR3/1600 and a Thermaltake ToughPower 1,050W PSU. The OS is 64-bit Windows 8.1. All games are run at 2560x1600 with 4xMSAA, except for 3DMark.

VERDICT 8

Sapphire R9 290 Vapor-X OC

ICE CREAM MAN High performance; runs very quiet and cool.

ICE TRUCK KILLER 2.5-slot card; sizeable power needs; a little pricey.

$500, www.sapphiretech.com

The HD 7950 Boost has been rebooted as the R9 280, now with less noise and a lower price tag.

MSI Radeon R9 280 Gaming 3G

A lot of boom for your buckaroo

AMD HAS announced an "all new" GPU named the R9 280. This entry will plug the gap between the $230 R7 270X and the $300 R9 280X (these are MSRP prices, btw). It's priced at $279 and goes head-to-head with Nvidia's GTX 770, which is priced at $329. Both cards are designed for maximum 1080p, are squarely in the zone of what we would call "good value" as they are somewhat affordable, let you run all games with maximum settings, and handle 1080p with very acceptable frame rates.

The reason we stated the R9 280 is a "new" GPU in quotes is that it's a new SKU for the R9 series, but it's really just a rebadged HD 7950 Tahiti board. Before you make nasty coughing sounds, keep in mind these second-gen Tahiti boards run much cooler and quieter than they did in their first generation, and with their prices significantly reduced, they are extremely competitive now. This month, we got our hands on the MSI Gaming edition of the card, which features its massive Twin Frozr cooling solution and a healthy overclock from 933MHz on the reference design all the way up to 1,000MHz right out of the box. It features 3GB of GDDR5 RAM just like the HD 7950, and is basically the same GPU except with a higher boost clock. In comparison to the slightly more expensive R9 280X, which is really an HD 7970, the R9 280 has fewer stream processors (1,792 versus 2,048) and slightly slower memory (5GHz versus 6GHz). The card has a 384-bit memory bus and a TDP of 250W, which is slightly higher than the HD 7950 due to the increased clock speeds. It features a Dual-link DVI port, HDMI, and two Mini DisplayPort outputs.

Since you've already seen this particular cooling mechanism many times, and we've all seen this card before in two other iterations (the HD 7950 and the R9 280X), let's get right to a discussion of its performance. There's a saying we have around the office, which goes, "There's no such thing as a free lunch." Translated into GPU performance, it means when a card costs less than another card, it's usually slower, and it's extremely rare for a card to be as fast or faster than a more-expensive competitor. That's just how it works, and we see it very clearly in the case of the R9 280 from MSI. This card isn't quite as fast as its GTX 770 arch rival, but then again, it's about $40 less expensive, too (MSI's GTX 770 with the same cooler is $340), so it's a teeny, tiny compromise. It will eventually offer support for Mantle, though, but since this is a Tahiti card, it does not support TrueAudio. Looking at the benchmark chart, we see the GTX 770 holding a clear advantage across the board, especially in Batman, which is an Nvidia title with PhysX, so AMD cards don't do well with those billowing plumes of smoke. All in all, though, we'd rate the R9 280 as a very playable 1080p card, even with all settings maxed and 4xAA. It's not 60fps, but it hit at least 30 in every game, so it's extremely playable in all the latest titles.

When it comes to overclocking, we were able to boost it up to 1,084MHz, which is damned good for an AMD card. The sizeable Twin Frozr cooler does an exceptional job of keeping things cool and quiet, too, with the card whispering sweet nothings under load and never getting hotter than 66 C.

Overall, this is a sweet card for 1080p gaming at the highest settings. It's cool and quiet, and it's priced reasonably. It's a tough call between it and the GTX 770, boiling down mostly to whether Mantle or ShadowPlay/G-Sync pull at your heart strings. –JOSH NOREM

BENCHMARKS

	MSI Radeon R9 280	GTX 770
Driver	14.3 Beta	335.23
3DMark	6,880	**7,062**
Heaven 4.0 (fps)	37	**44**
Crysis 3 (fps)	32	**38**
Tomb Raider (fps)	31	31
Metro: Last Light (fps)	31	**33**
Thief (fps)	45	**46**
Battlefield 4 (fps)	51	**55**
Batman: Arkham Origins (fps)	56	**90**
Assassin's Creed: Black Flag (fps)	29	**30**
CoD: Ghosts (fps)	56	**73**

Best scores are bolded. Our test bed is a 3.33GHz Core i7 3960X Extreme Edition in an Asus Rampage IV Extreme motherboard with 16GB of DDR3/1600 and a Thermaltake ToughPower 1,050W PSU. The OS is 64-bit Windows 8. All games are run at 1920x1080 with 4x AA except for the 3DMark tests.

VERDICT **9**

MSI Radeon R9 280 Gaming 3G

ULTRA HD Very fast and quiet; overclocks well; affordable-ish.

HD Will be priced higher than MSRP; last-gen features.

$280, http://us.msi.com

Silverstone Raven RVZ01

This DIY micro-tower takes flight

IT'S OFFICIAL: micro-towers are now definitely a "thing." Unfortunately for DIYers, being able to truly build from scratch hasn't been an option—until now.

Meet Silverstone's Raven RVZ01, a micro-tower that somewhat resembles a game console but has enough room inside for a high-powered PC. We actually used this enclosure in a recent Build It, and now we'd like to give it a proper review. The short version is that you can pack some powerhouse computing in here, but there are a few caveats.

The chief concern with the current wave of micro-towers is how difficult it can be to install a video card. We can settle that one right away: The bracket that holds the card is secured with a few standard Phillips screws. Remove those, lift the bracket out of the case, connect your card to the bracket's integrated PCI Express connector, attach your PCIe cables, and put the bracket back in. Easy peasy. There's even a slim 120mm fan preinstalled in that section of the case, to provide intake. Admittedly, this setup works best with a card that has a full "shroud," where hot exhaust comes directly out the back of the card, instead of getting circulated within the tower. But it's still an improvement over the usual mini-ITX setup, where the card gets an intake grill and nothing more.

The power supply also gets better-than-average treatment in this chassis. You'll need an SFX power supply instead of ATX, and these smaller units are currently limited to 450 watts. In our Build It, we found that was enough for a GeForce GTX 780 Ti and an Intel Core i7-4770K, but the Silverstone ST45SF-G's gold rating has a lot to do with that. A more common bronze PSU might not cut it. The space for cabling was also very tight, even when we used a PP05-E flat cable kit (also from Silverstone). And while the PSU has an intake grill on the other side of the case, it exhausts its heat internally, which isn't ideal. On the other hand, this is not unusual for a micro-tower. On the bright side, the bracket that holds the PSU is easy to access.

There is one unavoidable fly in the ointment, though. While the company's Facebook page featured a closed-loop liquid cooler (CLC) installed in this box, we couldn't find room for both the radiator and a fan of standard thickness. We had to settle for the Silverstone's bundled slim fan. Add the absence of air intake in this section of the case, and we were unable to overclock the CPU without running into heat issues. We ended up getting about the same performance as you would from a stock cooler, which undermines the option of putting an unlocked processor in the system—which in turn undermines the option of putting a high-end motherboard in the build.

You can still put some nice gear into this case, but a mini-ITX overclocker is better served with a "shoebox" design, such as the Cooler Master Elite 130, or a "cube" design, such as the BitFenix Prodigy. These can take CLCs and ATX power supplies, giving you more options. If you're not concerned about overclocking and just want something with a small footprint, though, the RVZ01 is really the only game in town right now.

–TOM MCNAMARA

VERDICT **8**

Silverstone Raven RVZ01

DAFFY DUCK Easy access to internals; plenty of GPU airflow.

A MURDER OF CROWS Limited cooling options; needs flat cables.

$85 (street), www.silverstonetek.com

An SFX power supply mounts vertically inside the RVZ01.

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The HS-260's audio cable and microphone are both replaceable, and can be plugged in on either side.

Func HS-260

Func's foray into gaming headsets starts on solid footing

FUNC'S NOT A new brand, per se—the company has been making gaming peripherals since the turn of the millennium. However, until just over a year ago, it was only known for mousepads, so its recent foray into mice and keyboards represents quite a step up, at least in terms of ambition. Now, with the HS-260, Func is ready to complete the trifecta and take on gaming headsets as well.

If the HS-260 is any indication, Func's got the makings of a gaming peripheral contender. It's not without its flaws, but as a freshman effort the analog HS-260 is very promising.

To begin, the HS-260 is well-constructed. It's a big set, with circumaural earcups that are large enough to provide plenty of room for even the biggest-eared among us. The plastic band is adjustable and pivots lightly where it meets the earcups, making for a flexible fit. The construction is all plastic, but all the materials feel solid and durable.

The design of the HS-260 is quite nice, with muted grays and matte blacks, plus just a hint of chrome to liven things up. The only touch of color in the whole set comes from the orange accents on the braided audio cable. If you prefer your accessories slick and a little on the understated side, this set definitely fits the bill.

The HS-260 comes with interchangeable fabric and leatherette earcups, so you can pick whichever finish you prefer. We found both nicely padded and very comfortable. The set feels good overall, though it's seriously heavy for a wired unit without built-in sound processing or multiple drivers or any of the other features that tend to weight down headsets. The headband is padded, but not by quite enough, and the "clamping" or inward lateral pressure of the headset is a little lower than average, leaving most of the weight bearing right down on the top of your head. All those factors combine to cause a mild headache after a couple hours of wear.

This is not a feature-heavy design, but those that are present are nicely implemented. The HS-260 has a single control on the set itself for volume, along with ports for the removable cable and microphone. The audio cable is braided, but lacks an in-line remote, which has become a fairly common feature. There's no software at all to go with the analog-only HS-260, so you're pretty much at the mercy of what your sound hardware can output. Whether that's a good or a bad thing is up to your particular circumstances.

Performance-wise, the HS-260 doesn't do much to stand out from the crowd. Like most gaming headsets, it's heavy on the bass, though the overall sound is a little lacking in power. We found ourselves needing to turn the volume up higher than usual to get a really immersive sound, and then some static would work its way in. The highs and mids are passable, but indistinct—for music, especially, the HS-260's balance is a little off.

That's not to say that there's anything *bad* about the HS-260's sound quality—in fact, there's really nothing bad about the set in general. It's feature-light, and physically heavy, but it's a solid headset overall and a surprisingly confident first effort. There's not too much to make this particular unit stand out from the pack, but we'll be watching to see what Func comes up with next. **–ALEX CASTLE**

VERDICT 7

Func HS-260

FUNCTIONAL Good build quality; swappable earcups; nice design.

DEFUNCT Heavy; middling sound quality; causes a headache; not many features.

$80, www.func.net

You can jam even a Radeon R9 290X in this baby.

MSI NightBlade

Bare-bones with a 'tude

SOMETIMES IT'S NICE to pick and choose every little component you want in your build, and sometimes it's just nice to have someone else do the thinking for you.

Nowhere is that more true than in the world of small form factor machines. While ATX towers are very forgiving to build into (you can't pick the wrong PSU or GPU), that can't be said of ITX PCs.

It's actually fairly easy to make missteps when building an SFF from the ground up, unless you pay very close attention to cable lengths, cooler size, and fan placement. It's this crowd that MSI's NightBlade should appeal to the most. It's an MSI-branded bare-bones box, to which you add storage, an OS, a CPU, and RAM, and you're good to go.

The NightBlade is a typical shoebox "shuttle form factor" that displaces about 16 liters, or 976 cubic inches as we say here in the free lands of 'Merica. That makes it slightly smaller than, say, the Cooler Master Elite 130 chassis. In fact, if you took the Cooler Master Elite 130 and turned it on its side, both would be about the same size and shape.

MSI, though, appears to have put some thought into the NightBlade. Since it's intended primarily as a compact gaming platform, one side of the case is heavily vented and ray-shielded, err, dust-shielded. This is where the big fat GPU is expected to get its air from. MSI says it takes GPUs up to 11.4 inches long and 1.37 inches wide. Basically, it'll take a Radeon R9 290X without issue. The bottom intake is kept clear with a clever stand-off that does double duty as a carrying handle. The handle is very study, and we had no qualms carrying a built-out NightBlade around the office with it.

The mobo inside the NightBlade is an MSI mini-ITX Z87i Gaming AC. The board features a pair of integrated rubber ducky antennas, and the company graciously includes an 802.11ac/Bluetooth 4.0 card. Other amenities include a 600-watt gold-rated PSU, Killer NIC E2200 networking chip, Creative Sound Blaster audio algorithms, and a nifty little SATA adapter cage that lets you install mSATA drives inside of it. The cage is about the size of a standard 2.5-inch SSD and has a standard power connector and two SATA 6Gb/s connectors. You can run the drives individually or in RAID. It's a good thing you get this, as the NightBlade is limited to 2.5-inch drives and a single 3.5-inch drive. For most people, that's enough, but we've seen designs such as Asrock's M8 that let you run no fewer than five 2.5-inch drives.

In the Kinda Neat department is a front-mounted "OC" button. Pushing the button when the machine is off turns on a subdued glow and, once the machine is booted, overclocks the chip up to 15 percent. On the Intel Core i5-4770K CPU we installed, the chip usually stayed at 3.5GHz with an occasional boost up to 3.9GHz. With the OC button engaged, we saw the NightBlade run at a permanent 4GHz overclock with a core voltage of 1.1 volts—that's a pretty safe OC for any K-series part. One might argue that the hard button is extraneous, since most overclock and leave it there. Others will say more buttons equal coolness. We went ahead and hit the chip with a Prime95 run for a couple of hours and encountered no instability or offensive acoustics. Noise with a hot GPU, such as the Radeon R9 290, was another matter. Our stock "reference" card would work its fans into a frenzy. MSI does include a plastic bracket that's labeled "Only for use with the R9 290X," but we installed a 120mm fan on it to use with our R9 290, and it helped bring down the card whine a little.

What the NightBlade really needed, though, was the ability to mount a closed-loop liquid cooler inside. At least in a way that's apparent to the average builder. We're sure you could hack one in, but we'd rather it be by design. The plastic fan mount isn't strong enough to hang a reservoir on, and the rear exhaust fan is an 80mm, so it's too small for most CLCs. We thought about mounting it directly to the door, but there's no clear mounting points for a cooler on it, either.

The NightBlade has an MSRP of $600, which was initially a turn-off, but on the street, the unit is pushing a reasonable $400. If you took the Cooler Master Elite 130, added the same MSI Z87I Gaming AC board, a 600-watt gold-rated PSU, fans, and a tower cooler, you'd be pushing about $400 at retail. Even the Asrock M8 micro-tower bare-bones machine is pricier at $550—although it does come with a slot-fed optical drive integrated. On the other hand, the NightBlade gives you that nifty mSATA drive adapter. So price-wise, it's probably a wash. The Asrock M8 also isn't technically rated to handle high-end GPUs, either.

Our only major ding, really, is the inability to mount a closed-loop liquid cooler for the CPU, and even that might be nitpicking. You'll only need the CLC if you're doing heavier overclocking than the 4GHz the NightBlade can hit. To be honest, we'd rather see a liquid-cooled GPU in the NightBlade than a liquid-cooled CPU.

–GORDON MAH UNG

MSI NightBlade

VERDICT

8

SLING BLADE Easy to build into; reasonably priced; nifty mSATA drive.

SWITCH BLADE Needs mounting point for water cooling; could use more storage bays.

$400 (street), www.msi.com

V3 Components Voltair

Don't call it a comeback

IF YOU'RE AN enthusiast who's ready to drop more than $100 on a CPU cooler, it's probably been a long time since you last considered air for this job. Most folks at this level have moved on to closed-loop liquid coolers (CLCs) or even custom loops. Even the best air-driven jobs on the market won't match the heat dissipation of a good CLC. So unless you're on a budget, why bother?

Well, the folks at V3 Components think they have the answer. By taking the tower radiator design that's common with high-performance air coolers and adding a Peltier plate to it, V3 believes there's life left in air. The Peltier plate has an electrical current passing through it in a way that makes one side cooler than the other, to help lower temperatures beyond that of a standard air cooler. That's the theory, anyway.

Peltier technology also needs a large radiator to handle all the heat it's throwing off, otherwise it can actually become insulation. Lately, liquid cooling has done this job. With the Voltair, a series of 8mm copper heat pipes tackle that duty. These pipes are in direct contact with the top of the CPU, for maximum heat transfer. This system also requires a particularly large tower radiator, and the Voltair has two fans attached. That'll take up a lot of real estate. You can remove the fans during installation, but we still had to screw down the radiator from the side, by hand. This meant pulling out our RAM and video card to get clearance, and it was still a little tight getting in there.

The fans use 3-pin connectors, and the kit comes with a fan controller that installs in an expansion in the rear of your case. The location of the dial isn't ideal, and a bit behind the times for a $130 cooler. We'd prefer the 4-pin PWM control that's become standard. On the bright side, V3 separated the installation parts and widgets into several different baggies, shaving some time and tedium off installation. We wish other vendors would do the same.

We've dealt with more awkward setups than this, though, and performance is what actually matters at the end of the day. But sadly, we couldn't get the Voltair to deliver. V3 Components said that the unit should perform on par with a CLC, but we couldn't get it to best the Cooler Master Hyper 212 Evo, a standard air cooler that you can snag for around $30. Part of the problem may be the distinct grooves in between each heat pipe, at the section where the pipes touch the top of the CPU. Air pockets can get trapped there if the thermal paste doesn't spread correctly.

V3 Components sent us a replacement unit in case the first one was faulty, and the second one performed slightly worse, hitting 87 C under load when we turned the fans down to about 1,100rpm, triggering a blue-screen error. V3's own testing with similar hardware indicated that performance should have been in line with a decent CLC, but we just weren't able to get in their ballpark, despite multiple re-installs, second opinions, and various tweaks. This made us wonder if part of the issue is the design of the nuts V3 uses. They don't bottom out or limit you during installation, so it's nigh impossible to know if you're mounted the cooler perfectly flat. The fine-course threads also mean you'll be turning forever.

The Voltair ended up being one of the most thoroughly tested coolers we've reviewed in a while, and the most puzzlingly disappointing. The company says that it's already looking at creating a smoother contact surface, so hopefully it will fare better next time. Our Intel Core i7-3960X CPU draws up to 165 watts in testing, though, so users of Intel's 1155/1150 CPUs *may* have better luck, since those chips use about half the power. **–TOM MCNAMARA**

VERDICT 5

V3 Components Voltair

PONTIAC FIREBIRD Well-organized packaging; clear instructions.

PONTIAC FIERO Poor performance; pricey; bulky heatsink; uneven contact surface.

$130 (MSRP), www.v3components.com

BENCHMARKS

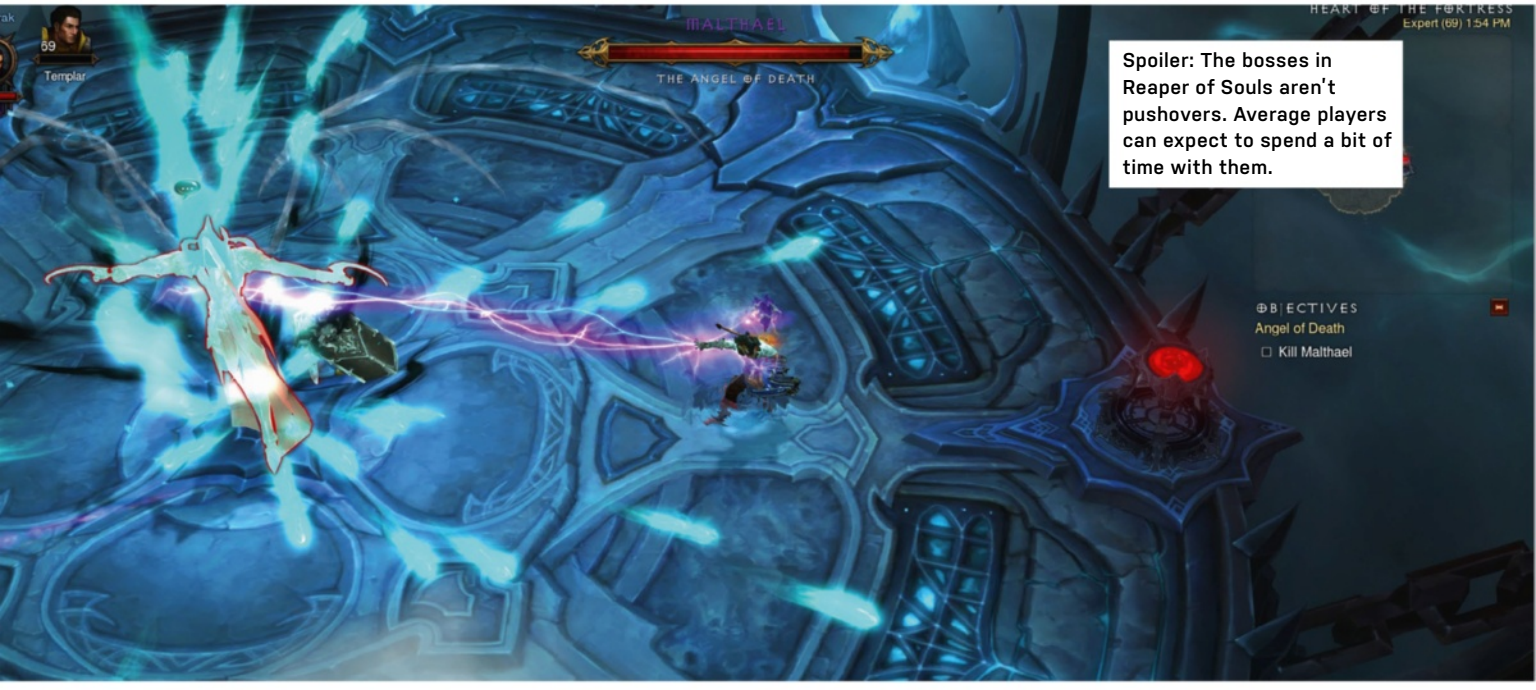
	V3 Voltair Quiet / Performance Mode	Nepton 280L Quiet / Performance Mode	Corsair H100i Quiet / Performance Mode	212 EVO Quiet / Performance Mode
Ambient Air	21.2 / 22.4	22.1 / 22.4	20.3 / 20.5	20.5 / 20.3
Idle Temperature	30 / 29	33.2 / 30	30.7 / 29.3	35.5 / 30.5
Load Temperature	DNF / 76.5	64.5 / 63.3	67.1 / 61	70 / 67.3
Load - Ambient	N/A / 54.1	**42.4** / 40.9	46.8 / **40.5**	49.5 / 47
Price	$130	$140	$140	$35

Best scores are bolded. All temperatures in degrees Celsius. All tests performed with an Intel Core i7-3960X at 4.2GHz, on an Asus Rampage IV Extreme motherboard, in a Corsair 900D with stock fans set to Standard.

SPECIFICATIONS

Dimensions (H x D x W)	6.8 x 6.7 x 4.7 inches
Weight	3.2 lbs
Stock Fans	2x 12cm 3-pin
Socket Support	LGA 1150/1155/1156/1366/2011; AM3/AM3+/FM1/FM2/FM2+
Additional Fan Support	none

The two fan cables are sleeved and grafted together for a cleaner installation.



Spoiler: The bosses in Reaper of Souls aren't pushovers. Average players can expect to spend a bit of time with them.

Diablo 3: Reaper of Souls

A much-needed kick in the pants revamps the franchise

WHEN WE LAST left our hero Diablo, the Lord of Terror wasn't all that scary anymore. In fact, he's probably been a bit lonely. The joy of killing Diablo 3's big boss alongside Blizzard's army of players has long since faded for those who haven't already abandoned the game at some point since its May 2012 release.

In its place, we've had endless runs: Al-kaizer. Crypt of the Ancients. Keywardens. Leveling through the game's Paragon system, introduced as part of Diablo 3's 1.0.4 patch in August 2012, sweetened the title's previously lamentable endgame by giving players an expanded goal to work toward. And work they did. Killing monsters rewarded players with experience to fill up to 100 of these "bonus levels," which successively increased their core stats (more killing power) and chances to find gear and gold—allowing them to tackle higher difficulty levels for... more experience. And more gear and gold.

You can never really *win* a game like Diablo. Only, you *sort-of* could if you were quite the little digital economist within Diablo 3's most controversial feature: The dreaded auction house. Your countless runs through the same enemy farming routes didn't just boost your character, it gave you precious items that could net you a fortune in digital gold—or actual, real-life cash, for those desperate enough for a boost to their characters.

Diablo 3's long-awaited expansion, Reaper of Souls, ushers in a new era for the title. It's much less controversial, and—dare we say it—a lot more fun, too. While the game's formula will never truly be perfect, nor the script especially compelling, there's plenty to do in Reaper of Souls that should excite even the most stalwart of Diablo 3 giver-uppers.

What's changed? Everything. Everything lame, that is.

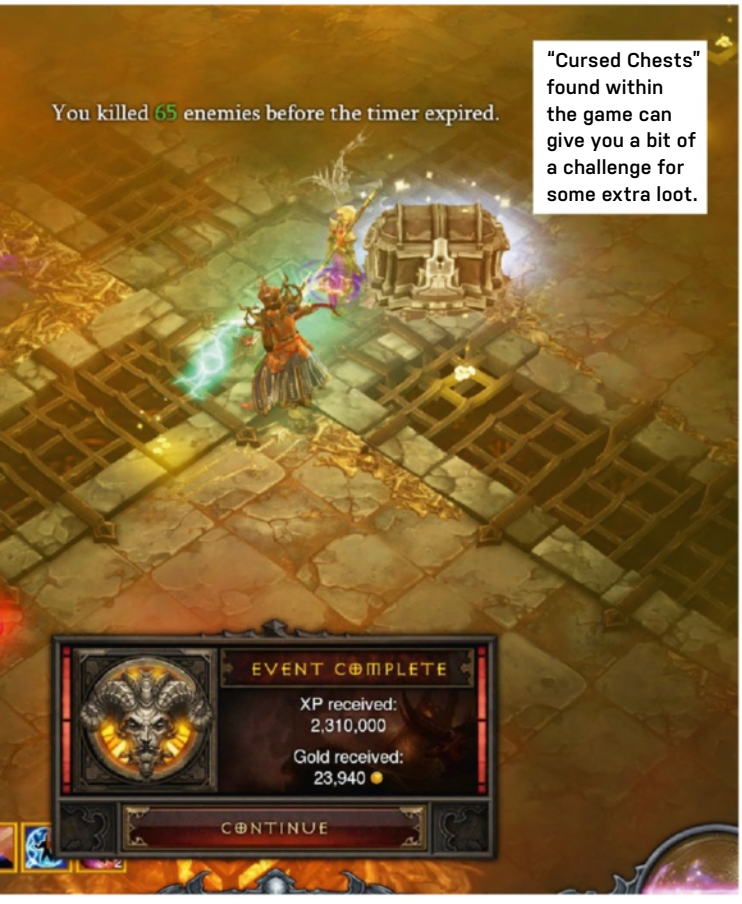
First up, the aforementioned auction house is no more. For that, we could not be more grateful. Little fun could be found in watching the price of seemingly mundane items skyrocket as a result of Diablo 3's inflation-filled failure of an economic system. As casual players, we hated knowing that achieving enough in-game gold to outfit a character even semi-properly was a pipe dream unless one instituted an 80-hour Diablo 3 work week.

That, coupled with the feeling that Diablo 3 baddies exploded with a ton of often-useless rewards for our character, made our progression feel more tedious than terrific. Happily, those times are long gone. The new Loot 2.0 system, unveiled as a patch alongside Reaper of Souls' release, ditches fluff for usability. Items that drop are fewer, but better, featuring stats that are far more in tune with what your character class could conceivably use. You'll be getting a lot more of the game's rarer legendary items, thanks to tweaked drop rates and reward rules. You can even spend resources to re-roll one stats on items that are *almost* perfect, via Diablo 3's newest NPC resource, the Mystic.

Once you've beaten Reaper of Souls' main quest—humans can be good or evil, and angels-turned-death-avatars don't like potentially evil things—the game unlocks "Adventure Mode." This game-within-a-game is a much-needed addition to the Diablo formula, as it entices players to revisit various parts of the game by giving them all sorts of bounties to complete.

Kill an act boss; clear a map of bad guys; finish a mini-quest; unlock a chest. Completing five of the various bounties in a given act grants a character a pat on the back from everyone's favorite (non-jerk) archangel, and a seraphim showcase showdown in the form of a cache of free items and gold, a huge chunk of experience, blood shards, and a rift stone.

Blood shards are part of Blizzard's similarly ingenious method of bringing back Diablo's tried-and-true "gambling" system, wherein one spends funds to receive a magical item whose properties are unknown prior to purchase. Since the auction house is no more, and spending one's sum-



"Cursed Chests" found within the game can give you a bit of a challenge for some extra loot.

Giant demon? Attacking my city? We think we'd probably just move at that point. You're on your own, Nephalem.

mer killing demons for that one, sought-after item can feel like an exercise in futility, the "blood shards" currency allows players to hone in on specific upgrades they're looking for by item type. If "DemonKilla89" needs a new pair of pants, you can spend this secondary currency to purchase random magical pants until, with luck, you've found a winner.

As for rift stones, spending these rarer trinkets unlocks "Nephalem Rifts" within the game's adventure mode. You get random dungeons to fight in that are filled with random baddies—and you'll kill a great many of these baddies before a more unique Rift boss appears. Kill it, and get a big reward. It's that easy. And to further incentivize players to try this system, the rifts themselves come with an even greater chance for finding (much-beloved) legendary items.

We appreciate Blizzard's efforts to counteract Diablo 3's old formula: Hit up waypoints in the main game, plow through an enemy-rich area, quit out, start a new game, hit up the waypoint, et cetera. It got tedious in its motions; worse, it got tedious in its aesthetic. While it could be said that a similar amount of tedium will eventually hit bounties and rifts, at least the game is forcing players to do different things in different places. It's a great change of pace to hit up areas (and bosses) in the Diablo 3 universe that would likely be left untraveled were gamers forced to find their own "best experience/loot runs."

The game's other major new addition, the Crusader class, is plenty fun, but we were a bit put off by the ease at which one can use completely legitimate exploits to power this, or any character, to maximum level within a few hours' time. While we agree that having to slog through the five-act campaign for each character you want to try out seems a bit much, there has to be a better solution than allowing level-70 buddies to speed-run newbies to the top. Perhaps offering unique elements as part of the legitimate leveling process could be a good way to let players customize their toons and prevent this mindless boosting.

This speaks to our core issue with the Diablo 3 world: It still lacks a sense of personalization. That's not to say that Blizzard hasn't accomplished much by transforming a benign offering into a beauté, but it's time for the company to make a player's efforts feel as if they matter beyond just the gear they carry or the achievements they unlock. Flood gamers with content, ideas, customizables, and maybe even (the long-awaited) PvP, and Diablo 3 will become as bright a (fallen) star in Blizzard's universe as its other addictive franchises.

Reaper of Souls brings Diablo 3 so far forward, it would be the biggest shame for Blizzard to negate this excellent momentum by not following up with even more specialized features to supplement the title's addictive elements. Give us more of a reason to roll two softcore Wizard characters at once, and we'll happily vanquish all the evil you send our way. –DAVID MURPHY

VERDICT 8

Diablo 3: Reaper of Souls

ANGEL OF DEATH Tremendous upgrades to gameplay, looting, and experience system; auction house is gone; excellent gameplay balance.

ARCHANGEL OF WISDOM We miss the amazing, character-driven, CG cutscenes; player characters lack personalization; could use even more skills, runes, and customization.

$40, http://us.battle.net/d3/en, ESRB: M

It's Halo, all right. You can even use the famed charging plasma pistol.

Halo: Spartan Assault

Stick to console (where Halo belongs)

FOR ITS LOW asking price of $5, Halo: Spartan Assault is perfectly priced for the kind of gameplay it delivers. We'd almost argue that it'd be better as a Flash/HTML5-based Web game than anything you should actually cough up money for, but a burrito's payment for a few hours of fun isn't that bad of a trade-off... just not on the PC.

Of course, if you're a Halo junkie, developers 343 Industries and Vanguard Entertainment could have probably charged $40 for this console port sans issue. The game faithfully recreates a (very simplified) version of the Halo universe in a top-down environment, where you play as one of two Spartan soldiers tasked with a variety of odds and ends as you fight off the evil Covenant and its attempts to activate a big, planet-destroying weapon. (No, it's not a Death Star.)

If we sound a bit cavalier about Spartan Assault's mission-based gameplay, it's because the game treats its 30 total missions just about the same way. To say that they're short would be a bit of an understatement. Most often, you're tasked with a single, simple objective that can take you anywhere from five to ten minutes to complete.

We're definitely not talking rocket science here. In one mission, you might be given a tank and told to blow up some stuff. Easy. In another, you might have to defend a base by hopping onto one of its machine-gun turrets and laying waste to everything that comes near you. Easier. We'd just as soon write off this game completely, were it not for the Halo series' tried-and-true mechanism of allowing gamers to ramp up the difficulty of a given mission by selecting various "skulls" prior to said mission's launch—attributes that makes things a bit more difficult, but award you more points.

Had we not thought to do so, blasting through the game's quick missions would have been about as easy as playing a deathmatch against a group of third-graders. While they're fun at first, we got a bit tired of the simplicity around halfway through Spartan Assault's campaign. Slapping on a few skulls does spice things up, but it also means that you'll have to restart levels when you die—a bit annoying when you eat it at the last second on one of the game's timed missions, but what can one do?

The game's experience system rewards players for kills, "medals" they earn for especially badass gameplay during the missions, and for completing missions as quickly as possible. Oddly, this experience can't be used to better one's Spartan per se; you use it to buy new guns, abilities, and power-ups, but you only get to use them for one mission. That's it. Fail the mission, quit the mission, or complete the mission, and you'll have to rebuy the upgrade if you want to do that again. No joke.

The point, we presume, is to give gamers more of a chance to earn mega points on missions, which they can then compare against their friends and fellow gamers. It's not the biggest replay incentive in the world; we think that a series of difficulty tiers, which would give a little more motivation for one purchasing crazier weaponry, would have been a better setup. Heck, even the inclusion of a multiplayer mode (which is available in the Xbox version) could have done wonders for the title's replay value.

If you need a quick fix in the Halo universe with a port that's worse than what you'll find on Microsoft's gaming consoles, have at it. Otherwise, save your cash and download it. At least you'll get to play with a friend. –DAVID MURPHY

VERDICT **3**

Halo: Spartan Assault

BIG MONEY Halo-y; good mix of guns and enemies; leaderboards; plenty of missions.

BIG PRIZES Lacks multiplayer; too easy; limited replay-ability; lacks excitement.

$5, http://bit.ly/MPC_halospartan, ESRB: T

This mATX case is small, yet can pack a CLC.

Lian Li PC-V360

Brushed-aluminum elegance—for a price

LIAN LI COMES to the microATX market with a case that looks like a shorter, dieting version of its peers. It's narrower and more vertically challenged than most microATX cases we've checked out, but you'd never guess that by the ample room inside the PC-V360 that the company gives you to play around with.

The problem? We don't really want to.

It's not that the miniature case lacks spirit. Installing a typical microATX motherboard didn't give us any issues whatsoever, and we especially appreciated the chassis' built-in motherboard standoffs. Securing up to four new PCIe devices—like our Nvidia GTX 480, which fit comfortably inside the case—was made a smidge more difficult through Lian Li's use of external screws for its add-in card brackets. However, we forgave this element as it granted us a bit more horizontal space inside the case to work with (you can even remove an included 2.5-inch drive cage if you need more room).

Pushing in a standard-sized power supply is a tight fit, though. The PSU itself doesn't brush up against the case's included top 12cm fan, but there's a very small amount of room for you to wedge your cables up against the case's other side panel and the rear of the motherboard tray. We just barely had enough clearance for our 24-pin main power connector, to put that in perspective. Cable management is tricky in this chassis; not impossible, but its limited space definitely requires a bit more thought. The narrow chassis will also limit your air-cooler options.

The case's single 5.25-inch drive bay is pretty standard, in that you'll be securing your component into the bay using provided thumbscrews. The case's five 3.5-inch drive bays are split by a single plate that allows you to convert one of these into a 2.5-inch bay (to accompany the three other 2.5-inch bays that come as part of the aforementioned removable drive cage).

Installing drives requires you to affix screws and rubber grommets to their sides, which you then slide into the slot and secure into place with a fairly ho-hum "gate" mechanism. We're not quite convinced of its usefulness versus a rails or tray setup, but the latter two options are certainly more convenient and probably more stable, too.

The internal cables for the case's two USB 3.0 ports and front-mounted 14cm fan are adequate in length, though we would have preferred more length for the case's front-panel connectors to allow for cleaning wiring runs. Even though this case is tight, you can wedge in a closed-loop cooler on a clever hinged bracket that's parallel to the CPU. It won't look pretty, and it might be a cabling/tubing nightmare to contend with, but it's possible. The CLC bracket (or fans) is one of the most pleasing elements the PC-V360 has to offer, though having more holes and room to mount different-sized fans/radiators would sweeten the deal.

Not so pleasing: The fact that the case's two USB ports are fixed on its right side, toward the front-bottom of the chassis. Put this case under your desk and you'll be all but touching the floor just to mount a USB cable. The design also limits your ability to, say, place the right side of your system against a wall. It's a minor quibble, but a more top-and-center USB positioning would be far better for ergonomics. The case also eschews any modern screwless features. In fact, it's almost the opposite of screwless.

While you get the classic "Lian Li" brushed-aluminum elegance, there is a steep price for it: $140. Aluminum will always cost more than steel, but that isn't our only problem. You're simply giving up a lot of modern amenities, and while the CLC bracket is clever, we think there are better options out there today. **–DAVID MURPHY**

VERDICT **5**

Lian Li PC-V360

HEARTHSTONE Lightweight; clever internal radiator mount; takes big GPUs.

STAR WARS TCG Tricky cable management; poorly placed USB ports; weird drive-mounting system; pricey.

$140, www.lian-li.com

LAB NOTES

RICHARD KOSCHER **ART DIRECTOR**

Change isn't good or bad—it just is

Four years of visual storytelling, and lots of fun

WHEN I FIRST STARTED at *Maximum PC*, and before I really knew any of the staff, I was sitting in a diner in L.A. with former coworkers from Lucasfilm, when someone asked what I was up to work-wise. When I replied that I was currently art-directing *Maximum PC*, my friend replied, "You know Gordon Mah Ung?"

I was somewhat surprised that Gordon was a household name in the PC world. Once I got to know the team, I realized how passionate they were about PCs. That's exactly the kind of work environment I was hoping for—passionate, collaborative, and energized. This is certainly one of the most knowledgeable and dedicated staffs I have ever had the pleasure of working with. One of the first things I did here was to redesign *Maximum PC*, and combined with excellent, in-depth, and compelling editorial content, the magazine was immediately recognized by the Western Publishing Association, who awarded us with two Maggie awards that year, one of which I had never had the pleasure of winning before: "Best Consumer Magazine." Seriously, that's like winning Best Film at the Oscars.

However, everything good comes to an end. As Don Draper said, "Change isn't good or bad—it just is." There are only so many "Dream Machine" covers you can design before it becomes routine, and in my book, design should never become routine. I have always approached design as a storytelling technique—working to make important ideas apparent through design, in order to tell a visual story to the reader. Now, thanks to the staff of *Maximum PC*, I have enriched my total of 23 years of storytelling through design by four years. Thanks for that, everyone!

Josh Norem, 20

JIMMY THANG

Online Managing Editor

I recently had the pleasure of attending PAX East and was blown away by the PC presence. Outside of Microsoft's Xbox One booth, I didn't see a single console on the show floor. If I were a game developer, I would concentrate on the PC. The platform has spawned numerous indie sensations like Audiosurf, Gone Home, and many more overnight hits (and that's not counting blockbusters like League of Legends). Love it or hate it, the PC is now where the cool kids hang out. Console diehards will complain about the PC's fragmentation, but that's also what makes the platform great. Options are a good thing—that's what compels me to be a PC user.

ALAINA YEE

Managing Editor

It's been a busy month of doing Windows XP upgrades for family members; my brain's still a little glazed over from all the manual backups and restores. (I think it's time to get everyone onto Crashplan. My treat.) In lockstep with moving into a new job, I've also taken the time to transfer the guts of my modest build into shiny new digs—I'm finally in modern times, having gone from a plasticky, circa 2006 small form factor case to a far more attractive, far better ventilated Silverstone SG10. Next step: upgrading each and every piece in the case, starting with the graphics card.

First Look:
Asus PB287Q Preview

Can 4K and TN mix? Apparently so

TN PANELS SUCK. They plain stink and will make your eyes bulge out as though someone threw open the airlock on Mars base, causing an explosive decompression.

If you're saying, "Give those people air with an IPS panel instead!" you might be right. At least, that's the uppity view of TN displays. TN, or twisted nematic, panels simply gets no respect from monitor snobs.

That's what Asus hopes to change with its new budget 4K panel. We know, you're thinking 4K and budget display are about as enticing as a ride on a budget submarine or using a budget parachute, but Asus thinks it has a strong offering: $649 for a 28-inch 4K monitor.

The PB287Q has a resolution of 3840x2160 pixels across the 16:9 aspect-ratio screen. As we said, the PB287Q is a TN panel, and Asus has not disclosed the manufacturer to us. It's spec'ed at a 1ms gray-to-gray refresh, which is typical of TN panels.

The good news is that the PB287Q supports 60Hz refresh rates using its single DisplayPort 1.2 port. To us, that's way better than Dell's budget 4K panel, the P2815Q, which it unveiled at the 2014 CES show. The panel initially set people abuzz with its then-aggressive price of $700—but then people realized the Dell panel only supports 30Hz. Period. As much as people say it doesn't matter, believe us, 30Hz on a flat panel is a deal-breaker any way you cut it. Simply moving a window across the screen will result in tearing and jitters that'll make you wish someone had opened up an airlock instead.

The Asus PB287Q has no such issue though, and we've seen proof of it in person in gaming and desktop use. With its 28-inch screen, you get a pixel density of 157 PPI. In other specs, the PB287Q sports a single DisplayPort 1.2 and two HDMI 1.4a ports—one of which is MHL compatible, so it'll let you hook supported tablets and phones through the micro-USB port. There's also the obligatory audio in and earphone jack on the panel.

We've now seen 4K panels at 32 inches, 24 inches, and 28 inches. We think 28 inches isn't a bad compromise between the two in sheer panel size. For 24-inch, you need bionic vision; the extra four inches makes it doable. Moving up to 32 (or larger) is actually better for 4K, but 28 is acceptable.

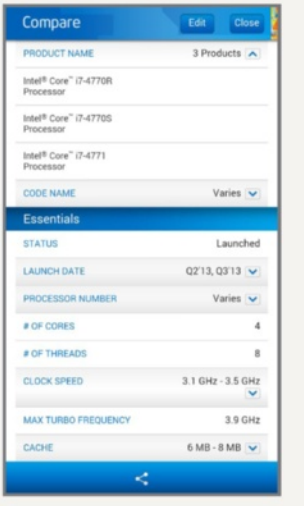
For the short time we had access to the PB287Q, we also viewed it off-axis and it was surprisingly good. We couldn't say it's as good as a quality IPS panel, as we didn't have one to compare side by side, but we think those who fear the typical horrible look of TN off-axis shouldn't be too afraid. Gaming and desktop use also looked impressive enough for a 4K panel that's $650.

Obviously, we'll have to wait to do a formal review before rendering any verdict, but at least the PB287Q gives us hope that affordable 4K computing is within reach, and without the limitations of Dell's budget 4K monitor. **–GMU**

Hang onto your wallet: This 4K panel will cost you just $650.

GEEK TESTED & APPROVED

Intel ARK Mobile App



Retail chips customarily have their make and model printed on top for easy identification. But at our offices, we frequently get engineering samples tagged with four-digit codes instead. That's where Intel's ARK website comes in. It's a searchable database of pretty much every retail chip the company makes. Its mobile app takes things one step further by downloading the database to your mobile device, so you don't need to have an Internet connection to browse it. And it won't check for database updates until you ask it to, instead saving those precious data plan megabytes for the usual *Maximum PC* podcasts and pictures of cats on Reddit. You can do side-by-side comparisons of different chips; search using assorted criteria like product numbers, clock speeds, and ordering codes; browse in phone-style portrait mode or tablet-friendly landscape mode; and impress your friends and neighbors with your encyclopedic knowledge about an esoteric CPU from 2012. Free, http://bit.ly/intelark (Android), http://bit.ly/intelark2 (iOS) **–TM**

LETTERS

WE TACKLE TOUGH READER QUESTIONS ON...

> We're Big with Boy Scouts
> Grousing Gordon
> Gaming GPU Advice

Is There an Overclocking Merit Badge?

I am a Boy Scout from Troop 889 in Naperville, IL. I think *Maximum PC* is great. I have been reading it for more than four years, ever since finding it in the library. I now subscribe because I really enjoyed reading it. My favorite issue was the Dream Machine issue from 2010 and it inspired me to build my own computer after using laptops that could barely run any game at 15 frames per second. It took me a while to convince myself to spend the money to do it, but after I built it, I thought it was worth the money. Today, I play games like DOTA 2 and Sid Meier's Civ V, and they run really smoothly with my Nvidia GTX 650 Ti.

—Stephen Ehlert

Quit Your Whining, Gordon

Gordon's incessant defense of the PC as a platform is getting tiresome and repetitive. Especially to those of us who believe that "It's all good" and use multiple platforms as we want.

What Gordon needs to understand that his use-case is not the masses. That even though he is a content creator, most people are content consumers. And that's OK, and he shouldn't go disparaging people for not being as PC-partisan as he is. They simply don't "need" a PC for the vast majority of their uses. And while they probably do have PCs, they do a lot of their computing on their mobile devices and/or game on game consoles.

It's kind of like pickup/utility trucks. There are few people who actually need to haul things. Then there are the guys who bought one to feel macho and brag about how much horsepower it has, but only drive it back and forth to their office job in the suburbs. Then there are those who don't need one, and whose needs are met by a compact, fuel-efficient vehicle.

Gordon, you are now part of a niche market. Accept it, move on, and quit whining about how the masses are using tablets or consoles.

—Ron Rogers, Jr.

Or, Maybe Just Keep Whining

Every time I open the latest *Maximum PC*, I am always proud to discover that Gordon is there (yet again) boasting about the importance of the PC. Being a small business owner of a new custom-computer company, I always try to push the power that can only truly be provided by a home computer system—the limitless modifications, upgrades, etc. The world is so consumed by mobile computing, and it is a gut-wrenching conversation that I must endure when explaining my stance on the preferred computing of today. Honestly, there is nothing more exciting than coming home, sitting in front of my 32-inch screen, and pressing the power button on my tower. With a nearly 10-second system boot (thanks, SSD) to lightning-fast operations, I cannot say that a mobile solution will do what I need. To bring this to a close, I just want to say thank you. Keep pushing the way you are. All of

Advertorial

Did you know?

Did you know that there is a new premium TV app, called iTVmediaPlayer, which provides access to over one million full-length, premium movies and TV shows and over 200,000 TV channels? This is something way beyond Cable, Satellite, Netflix or Hulu.

As per its official website description, iTVmediaPlayer is a software (or app) that provides you access to over one million full-length, premium movies and TV shows and over 200,000 TV channels (streamed live and on-demand; most available in HD.) There are no monthly or yearly fees required. iTVmediaPlayer is compatible with all Windows PC systems and Android devices (including smart phones and tablets.)

For a larger image, you can always connect your computer (or mobile device) to your home TV, using an HDMI cable (or otherwise.) If you think about it, iTVmediaPlayer could be your alternative to expensive Cable or Satellite TV service.

Visit the official website and download iTVmediaPlayer today, at:
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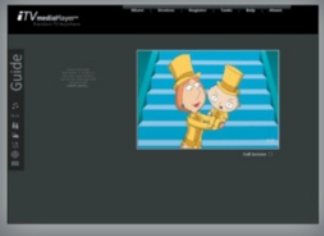


↘ submit your questions to:
comments@maximumpc.com

us power users appreciate the angle.

—Jason Kubb

This Thread Is Worthless Without Pictures

Recently, a reader asked about two power supplies and running them over time. I have been reading *Maximum PC* since 2009. I read, with much interest, your article about the New Dream Machine 2010 using the largest motherboard ever at that time, the EVGA SR-2. I decided there and then to build that sucker. I put everything together and just as you did, I am running two PSUs: a Thermaltake 1,200W and a Corsair 700W connected with a Lian Li 24-pin splitter.

The 1,200 powers the mobo, two Intel Xeon E5645, two H60 closed-loop coolers, Asus GTX 660 Ti video card, Hauppauge TV card, 24GB of Patriot DDR3, and a Creative Fatal1ty X-fi. The Corsair supplies juice to four 750GB hard drives, two 256GB Samsung EVOs, and 16 case fans running through a Sunbeam fan controller.

The computer runs a minimum of 12 hours a day, seven-days a week, and since I am a retired computer tech, time is something I have a lot of. I play Skyrim Legendary Edition and Dragon Age Ultimate. One thing's for certain, this thing draws a lot of power. It shows up on the electric bill, but the fact that we have 5,040 watts of solar power takes some of the guilt away. One last note: I will be 70 this year, so anyone can do this. Keep up the good fight, the PC is NOT dead.

—Gary Grady

Taking Flight with PC Gaming

I am an amateur PC user and just have a question regarding a graphics card. I do not currently have a graphics card in my computer, but I would like to start using my desktop PC for gaming. I am looking into playing games like Flight Simulator, League of Legends, etc., and would just like to know which graphics card I should get for $250.

—Matt Briand

ASSOCIATE EDITOR TOM MCNAMARA RESPONDS: In the $250 price range, your best bet is the GeForce GTX 760. EVGA, Asus, MSI, and Gigabyte all make good versions with their own proprietary coolers. I'd recommend 500 watts or more for your power supply, though, and the PSU needs to come with two PCI Express cables to give the card enough power. If the 750 Ti is any indication, Nvidia's upcoming "Maxwell" architecture will need much less power than before. But it's apparently not coming out for a while, so we'll need more juice until then.

I Want My Synology NAS

I enjoyed the article but have a question and/or comment. The two most established players in the SMB and consumer NAS space are almost always quoted as being Qnap and Synology. How is it that Synology did not get reviewed? Did they decline to offer a model for review or did your research into this market segment somehow miss Synology as a key player? Just to be clear, I have no affiliation with Synology, and use Qnap myself for my home and business.

—Michael Yasumoto

EDITOR IN CHIEF GORDON MAH UNG RESPONDS: We asked Synology to submit a unit for review but the company declined to be included in our roundup. This wasn't done because there is animosity between *Maximum PC* and Synology. The company decided not to participate because it feels there's no advantage to stand in a crowd of competitors and would prefer a standalone review, which we plan to do.

[NOW ONLINE]

HOW TO PHYSICALLY CLEAN YOUR PC AND MORE

You might be a whiz when it comes to degunkifying your PC of malicious software and removing redundant files, but do you know how to physically clean your hardware? If not, we'll show you how to wipe down your rig like a pro. In our online article, we showcase all the tools you'll need (spoiler: lots of compressed air will be involved) and show step-by-step instructions (with pictures!) on how to properly clean everything from your computer chassis to your gaming mouse. http://bit.ly/MPC_clean

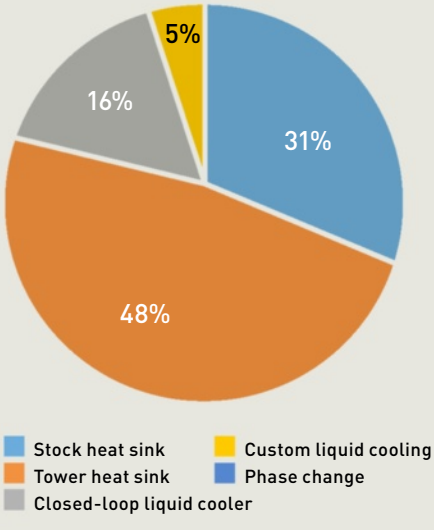
Facebook Polls

How Large Does Your SSD Have to Be Before You Stop Building PCs with a Hard Drive?

Solid-state drives are super-speedy, but they're not cheap. We asked our followers on Facebook about where the future of their storage is pointing. Here are some favorites.

Aries Li: 3.5 inches.
Jeremy Yam: I don't actually care about how large the SSD is, rather the price.
Justin N Shannon: Some will say... size doesn't matter.
Josh Jangula: 1.21 gigawatts.
David Schowalter: No reason to stop until your PC develops its own gravitational pull.
Justin Smith: They need to fix the god-awful failure rates on these before they become the norm.
Richard Guernsey: I think you mean "how cheap."
Dallas Troy Powers: Large enough to replace money in wallet.
David A. Lessnau: I haven't had a hard drive in a computer since 2009, when I installed a 160GB Intel X25M.
Zachariah Pickup: The largest one possible.
Kevin Richardson: The price needs to be slashed and SSDs need to mature before I'll even consider it.

How Do You Cool Your Rig?



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THE BUILDS

BUDGET

INGREDIENTS

PART			PRICE
Case	NZXT Source 210 Elite		$50
PSU	Corsair CX500 500W		$30
Mobo	Biostar TA970		$80
CPU	AMD FX-6300		$110
Cooler	Cooler Master Hyper 212 Evo		$35
GPU	Sapphire Radeon R7 265	NEW	$160
RAM	2x 4GB G.SKILL Ares Series DDR3/1600	NEW	$69
SSD	120GB Samsung 840 EVO	NEW	$81
HDD	1TB Seagate Barracuda		$65
OS	Windows 8.1 64-bit OEM		$100

Approximate Price: $780

AMD'S FX-6300 CPU remains a great value for budget-minded gamers, ensuring another month in this build, and the Biostar TA970 motherboard is a solid platform for the money. You could save more scratch with a microATX board, but we prefer the additional expansion slots. We've swapped the Nvidia GeForce GTX 750 Ti for a Radeon R7 265, since you get moderately better performance for the same cost. We've changed the RAM in response to the usual market fluctuations. The last time this build appeared, it had a Kingston SSDNow V300 drive. It has since come to our attention that certain units now have asynchronous DRAM chips, which impacts performance. The Samsung 840 EVO, meanwhile, is snappy all around, and it comes with a polished software package for further tweaking.

BASELINE

INGREDIENTS

PART			PRICE
Case	Corsair Vengeance C70		$108
PSU	Rosewill Hive-750 750W	NEW	$92
Mobo	Gigabyte G1.Sniper Z87		$153
CPU	Intel Core i5-4670K		$240
Cooler	Cooler Master Hyper 212 Evo		$35
GPU	EVGA GeForce GTX 760 02G-P4-2763-KR		$260
RAM	2x 4GB G.SKILL Ares Series DDR3/1600	NEW	$69
Optical Drive	Samsung SH-224DB/BEBE		$20
SSD	250GB Samsung 840 EVO		$150
HDD	1TB Seagate Barracuda		$65
OS	Windows 8.1 64-bit OEM		$100

Approximate Price: $1,292

THE CORSAIR TX750M is a great power supply, but its price has gone up a bit, so we're replacing it with the Rosewill Hive-750. We've switched our RAM because of price variations, too. Other than that, we're sticking with the Intel Core i5-4670K CPU for its combination of high performance and reasonable pricing. The Gigabyte G1.Sniper Z87 board has a surprising amount of premium features for the price, like isolated audio circuits and intelligent network load balancing. The Nvidia GTX 760 is still the best value for gaming, and EVGA's version with the "ACX" cooler will keep things quiet. The 250GB Samsung 840 EVO SSD has a great combo of performance and tweaking software, with its "Rapid Mode" enabling a 2GB RAM buffer for an extra boost of speed.

PERFORMANCE

THE "PERFORMANCE" tier remains stable with a beefy Core i7-4820K and an Asus Sabertooth X79 motherboard. These are both high-octane parts, and we're adding a Corsair H100i closed-loop liquid cooler for the CPU, to help it reach some high overclocks. We used this board for a long time in a previous test rig, so we know that it's solid and dependable. We've upgraded the power supply from 850 watts to 1,000 watts, to give you even more room to add additional video cards (which are the hungriest part of an enthusiast rig). We've used the 720-watt version in previous Build It rigs. Speaking of cards, we could upgrade from an Nvidia GTX 780 to a 780 Ti, but a roughly $200 gap is hard to justify, given the relatively modest gains in performance. This regular 780 is also overclocked, anyway. We did splurge on a Blu-ray burner, though, so maybe we're just a little eccentric.

There's a lot of competition to the Samsung 840 EVO, but we'll stick with it because none of the others have anything quite like Samsung's "Magician" tweaking software.

INGREDIENTS

PART		PRICE
Case	NZXT Phantom 530	$130
PSU	Cooler Master Silent Pro M2 1,000W NEW	$160
Mobo	Asus Sabertooth X79	$320
CPU	Intel Core i7-4820K	$325
Cooler	Corsair H100i	$95
GPU	EVGA GeForce GTX 780 03G-P4-3784-KR	$530
RAM	4x 4GB G.SKILL Ripjaws F3-12800CL9Q 16GBRL	$150
Optical Drive	LG WH16NS40 Blu-ray Burner	$70
SSD	500GB Samsung 840 EVO	$255
HDD	3TB Seagate Barracuda	$110
OS	Windows 8.1 64-bit OEM	$100

Approximate Price: $2,245

For more of our component recommendations, visit www.maximumpc.com/best-of-the-best.

UPGRADE OF THE MONTH
NZXT G10 GPU BRACKET

A stock or "reference" video card will get the job done, but it can get hot and loud. Replacing its heatsink and fan with NZXT's Kraken G10 might help bring down your heat and noise, though you need to bring your own closed-loop liquid cooler to complete the picture.

$30, www.nzxt.com

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